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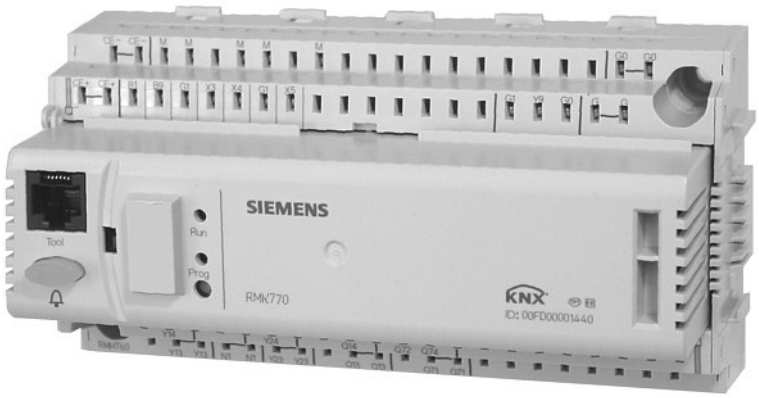

Synco™ 700
Modular boiler sequence controller RMK770
including extension modules RMZ785, RMZ787, RMZ788 and RMZ789

Basic Documentation

Edition 2.1
Controller series B
CE1P3132en
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Building Technologies

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Contents

1 Summary

1.1 Product range

Type of unit	*Description*	*Product no.*
Controller	Boiler sequence controller	**RMK770**
Extension modules	Universal module with 8 inputs	**RMZ785**
	Universal module with 4 inputs and 4 relay outputs	**RMZ787**
	Universal module with 4 inputs, 2 analog outputs and 2 relay outputs	**RMZ788**
	Universal module with 6 inputs, 2 analog outputs and 4 relay outputs	**RMZ789**
Module connector	For detached extension modules	**RMZ780**
Operator units	Operator unit, plug-in type	**RMZ790**
	Operator unit, detached	**RMZ791**
	KNX bus operator unit	**RMZ792**
Service unit	Service tool	**OCI700.1**

RMK770

RMZ785

RMZ787

RMZ788

RMZ789

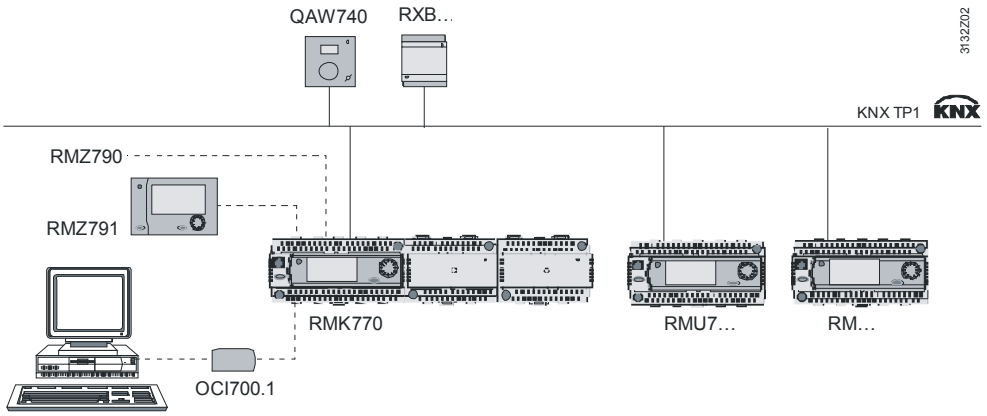
RMZ780

RMZ790

RMZ791

RMZ792

1.2 System topology



1.3 Equipment combinations

Description	*Technical data / product no.*	*Data Sheet no.*
Passive sensors	Sensors using sensing elements LG-Ni1000, Pt 1000 or T1 (PTC)	N1721…N1846, N1713
Active sensors	Sensors • operating on AC 24 V • with modulating DC 0…10 V output	 N1821, N1850…N1932
Monitors	RAK… QBM81… QVE1900, QVE1901	N1186…N1190 N1552 N1592, N1594
Room units	QAA25, QAA27 QAW740	N1721 N1633
Passive setpoint adjusters	QAA25, QAA27 BSG21…	N1721 N1991
Active signal sources	BSG61	 N1992
Actuating devices	Electromotoric and electrohydraulic actuators • operating on AC 24 V • 3-position control • modulating control DC 0..10 V 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 on the safe and correct deployment and operation of Synco™ 700 products in building services plant.

Type of document	*Classification no.*
Product range description "HVAC controllers with KNX interface”	S3110
Data Sheet ”Boiler sequence controller RMK770”	N3132
Data Sheet “Universal modules RMZ785, RMZ787, RMZ788, RMZ789”	N3146
Data Sheet “Module connector RMZ780”	N3138
Data Sheet “KNX bus”	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 RMH760B-1 and RMK770-1 (de, fr, it, es)	B3133x1
Operating Instructions for RMH760B-2 and RMK770-2 (en, de, fr, nl)	B3133x2
Operating Instructions for RMH760B-3 and RMK770-3 (sv, fi, no, da)	B3133x3
Operating Instructions for RMH760B-4 and RMK770-4 (pl, cs, sk, hu, ru, bg)	B3133x4
Operating Instructions for RMH760B-5 and RMK770-5 (sr, hr, sl, ro, el, tk)	B3133x5
Basic Documentation “Communication via KNX bus“	P3127
Declaration of CE Conformity, Synco™ 700	T3110
Environmental Declaration for controller RMK770	E3132
Mounting Instructions for extension modules RMZ78…	E3110…02
Environmental Declaration for operator units RMZ790 and RMZ791	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™ products are proper transport, installation and commissioning, as well as correct 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™ products must be undertaken by qualified staff who have been appropriately trained by Siemens Building Technologies.

Operation

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

Wiring

When wiring the system, the AC 230 V section must be strictly segregated from the AC 24 V safety extra low-voltage (SELV) section in order to ensure protection against electric shock hazard!

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 Siemens Building Technologies.

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 Siemens Building Technologies service staff.

⚠ Only authorized staff are permitted to perform 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
- Local and currently valid legislation must be observed

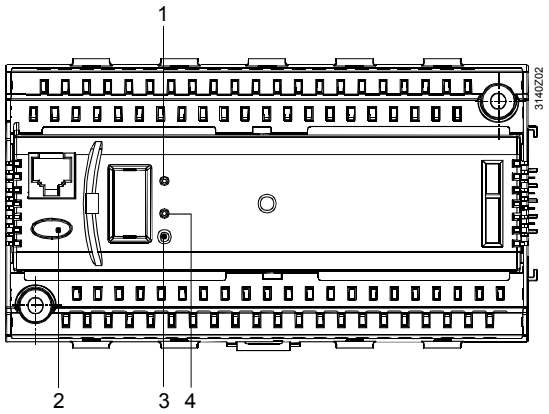
2 Operation

⚠

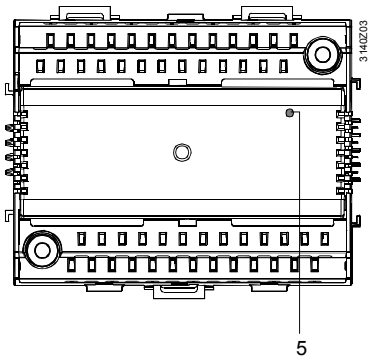
Synco™ 700 devices may only be operated by staff who have been instructed by Siemens Building Technologies or their delegates and whose attention has been drawn to potential risks.

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 device's operating state:
- *LED lit:* Power on, correct use and
- *LED off:* No power or incorrect use / faulty peripheral devices

2 Button 🔔 with LED (red) for indicating fault status messages and their acknowledgement:
- *LED blinks:* 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:* Acknowledge or reset fault

3 Program button (Prog): Learning button for switching between normal mode and addressing mode for adopting the physical device address (tool required)

4 Programming LED (Prog): LED for indicating "Normal mode" (LED off) or "Addressing mode" (LED on); it goes off automatically after the physical address has been adopted

5 LED (Run) for monitoring power supply and module addressing:
- *LED lit:* Power on, module addressing lit
- *LED blinks:* Power on, but module has not yet been addressed by the controller
- *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.

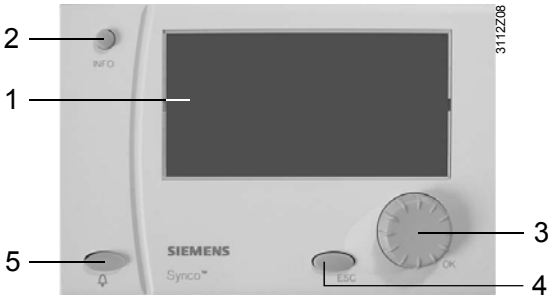
2.2.2 Operating concept

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. The LCD shows all menus in cleartext.
The controller is supplied with several languages programmed; when commissioning the plant, the required language must 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-push knob
- *Turn:* Menu option or adjustment of value
- *Press:* Confirm menu line or setting

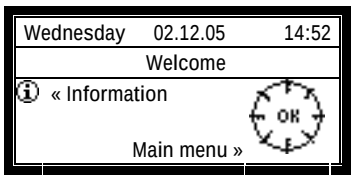
4 ESC button: Going back to the previous menu

5 Fault button with LED
- *LED:* Fault
- *Press:* Acknowledge or reset fault

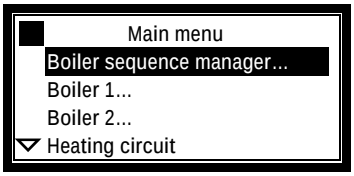
When one of the operating elements is operated, the backlit display is automatically switched on. If the controller is not operated for 30 minutes, the operator unit switches itself off and the start page appears.

Display examples

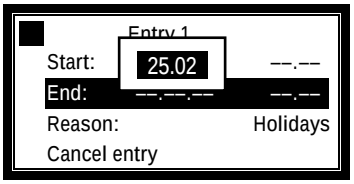
Start display:



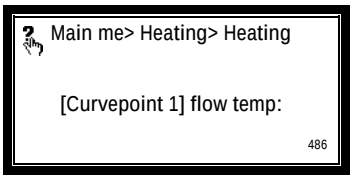
Setting level. Selection of a setting parameter,
e.g. from the Main menu of the user level:



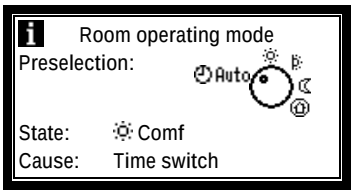
Setting level, pop-up, setting a numerical value:



Setting level, Help picture ”Explanations relating to the selected datapoint”. The text identification number of the menu tree appears in the corner at bottom right (only access levels “Service level” and “Password”):



Info level, “Display of key plant data”:



2.2.3 Operating levels

There are 2 operating levels:

- The Info level ■
- The setting level ■
- These 2 levels are always active, independent of the access level currently used

Info level ■

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*	*Icon*
User level (for the plant operator)	The user level is always accessible. The alterable datapoints displayed here can be changed by the plant operator	
Service level (for the service engineer)	Press OK knob and ESC button simultaneously. Then, select operating line ”Service level” and confirm by pressing the OK knob	
Password level (for the expert)	**Commissioning:** Press OK knob and ESC button simultaneously. Then, select operating line "Password” and confirm by pressing the OK knob. Enter number 7 for the password and confirm by pressing the OK knob	
	District heat parameters: Press OK knob and ESC button simultaneously. Then, select parameter Password level and confirm by pressing the OK knob. Enter number 11 for the password and confirm by pressing the OK knob	

Individual menu items or datapoints are enabled depending on the access level. On a higher access level, it is always possible to also display all menu items and datapoints of the lower access levels.
There is only 1 menu (the password level shows the entire menu).

Switching to another access level

- After a time-out (30 minutes with no operation on the controller), the controller switches to the user level
- Switching from the current access level to another access level:
  1. Press the OK knob and the ESC button simultaneously. The Access levels menu appears.
  2. Select the required access level by turning the OK knob and confirm by pressing the knob.
  3. Enter number 7 as a 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 provided by the district heat utility.
After entering the respective password, the settings for maximum limitation of the return temperature and for pulse limitations can be made.

3 Commissioning

⚠ Preparation for use and commissioning of Synco™ 700 controllers must be undertaken by qualified staff who have been appropriately trained by Siemens Building Technologies.

3.1 Basic concept

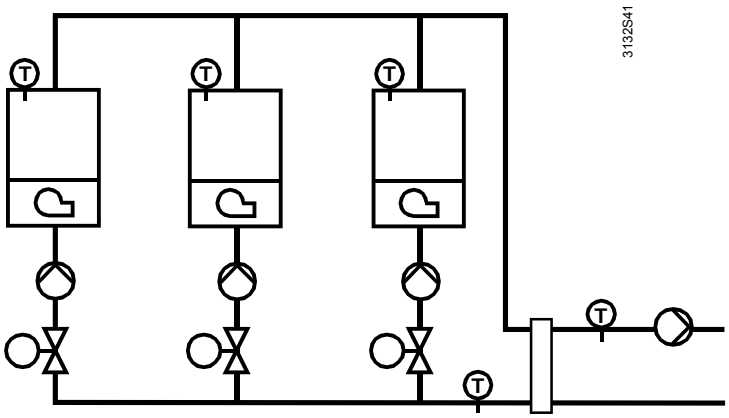
Using the RMK770 controller, boiler sequencing can include up to 6 boilers. When selecting a plant type, boiler sequencing with 2 boilers is predefined. Boiler hydraulics and the type of burner selected with the plant type in the basic configuration always apply to both boilers. Any adaptations in terms of boiler hydraulics and type of burner can subsequently be made in the extra configuration. By selecting a plant type that is very similar to the actual plant, adaptations can be kept to a minimum. But it is also possible to start with basic type K and then add all plant elements in the extra configuration.

The boilers predefined with the plant type are assigned to boiler 1 and boiler 2. They are also given boiler addresses 1 and 2 on the KNX bus. Further, by selecting the plant type, the common main flow and main return temperature sensors are predefined.
If additional boilers need to be configured, this is to be made via the Extra configuration menu. For additional boilers, each plant element (burner stages, boiler sensor, etc.) must be configured separately.

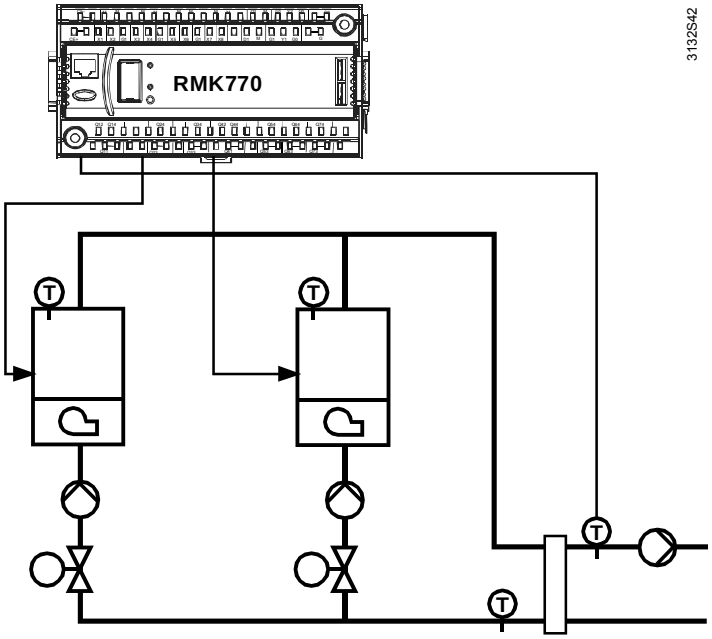
When a second RMK770 controller is used with the third boiler, the start must be made on the second RMK770 with basic type K. The plant components must now be assigned to boiler 3. On the RMK770 with boilers 1 and 2, the number of boilers must be increased to 3 via the Settings > Boiler sequence manager menu. As a result, boiler 3 is automatically included as a boiler of the boiler sequence, to be displayed on the first RMK770 controller in the overview on the information level.

Example

Boiler sequence with 3 boilers, each equipped with a 1-stage burner.



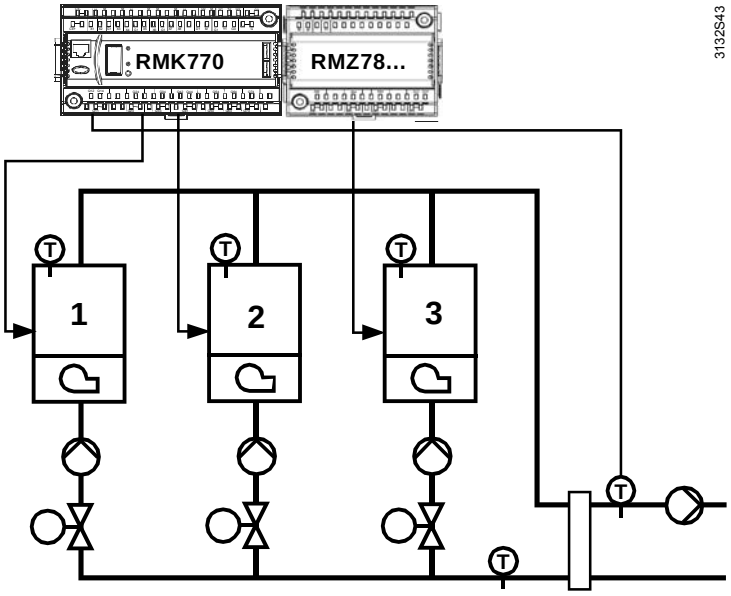
First, select plant type K5.1 because it corresponds to the required boiler hydraulics and the types of burner (refer to subsection 3.3.1 “Plant types”).



To integrate the third boiler, 2 choices are available:

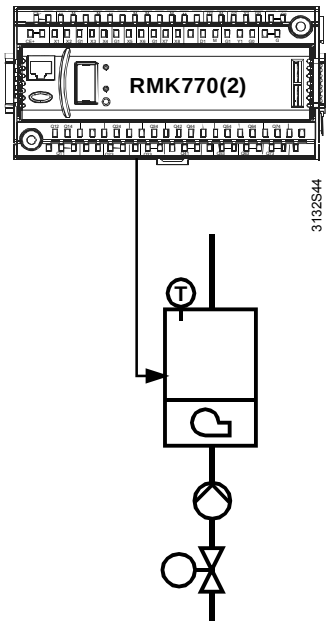
Variant with extension module

Since the RMK770 controller does not have a sufficient number of outputs, an extension module is required.
Now, in the extra configuration, boiler 3 is assigned the boiler temperature sensor, the first burner stage, the boiler pump and the shutoff valve.



Variant with a second RMK770

Depending on the type of plant, it may be practical to use a second RMK770 controller with the third boiler. On that second RMK770, select basic type K and – in the extra configuration – assign boiler 3 the plant components boiler temperature sensor, burner stage 1, boiler pump and shutoff valve.

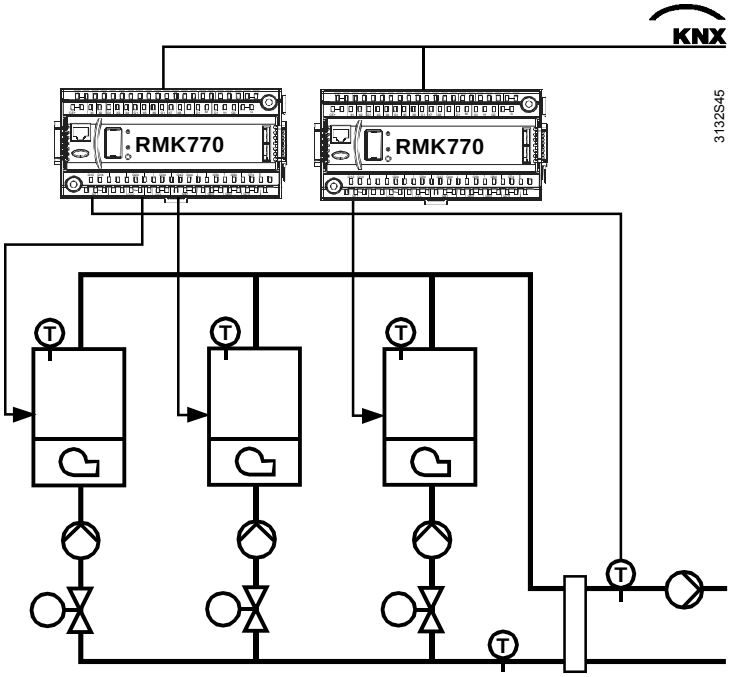


Also, on the first RMK770, the “Number of boilers“ must be set to 3, thus informing the boiler sequence manager that a third boiler must be controlled via bus.

Main menu > Commissioning > Settings > .... or

Main menu > Settings > Boiler sequence manager

Operating line	*Range*	*Factory setting*
Number of boilers	1…6	2



3.2 Entering the commissioning mode

⚠

During commissioning, the plant's control and safety functions remain deactivated. The relays maintain their normal position, 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 for commissioning and plant operation 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 appears.
The access level is automatically set to "Password level".
The Plant type menu offers 1 "empty plant" and 18 ready configured plant types.

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

3.3 Basic configuration

A plant must always be configured on the password level .

Main menu > Commissioning > Basic configuration

Operating line	*Adjustable values / remarks*
Plant type	Basic type K, K1.1…K6.3
Position 1	---, RMZ785, RMZ787, RMZ788 , RMZ789
Position 2	---, RMZ785, RMZ787, RMZ788 , RMZ789
Position 3	---, RMZ785, RMZ787, RMZ788 , RMZ789

Plant type

Operating line "Plant type" is used to enter or display the type of plant.

Position

On lines "Position 1" through "Position 3", 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.
--- = no module present

3.3.1 Plant types

⚠

The first setting to be made is always the "Plant type" because when selecting the plant type, 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

Basic type and plant types

The RMK770 controller contains 18 plant types. Each plant type can be changed or complemented in the extra configuration.
Basic type K is the 19th plant type. With basic type K, no configuration is made. This plant type is selected when a second RMK770 is required for the boiler sequence. For more detailed information, refer to section 3.4 "Extra configuration". When, in the following, reference is made to the basic configuration, we always speak of plant types K1.1…K6.3.

Plant type

The plant type is made up of a 2-digit number, e.g. K2.3:

- The first digit defines the type of hydraulic circuit of the boiler sequence
- The second digit defines the type of burner or the type of burner control:
  - Kx.1: 1-stage burner
  - Kx.2: 2-stage burner
  - Kx.3: Modulating burner with 3-position control
- For DC 0…10 V control of a modulating burner, the 1-stage burner is used as the basic stage. In addition, a DC 0…10 V output must be assigned in the extra configuration
- The plant type always applies to a boiler sequence
  - with 2 boilers
  - and using the same type of burner

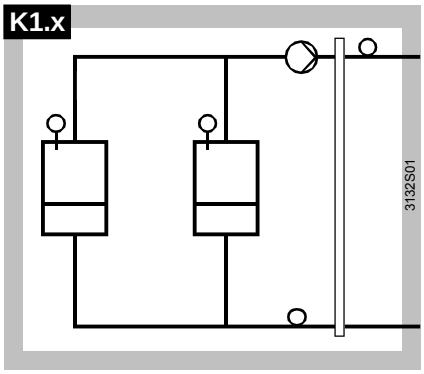
  Additional boilers, other types of burner, a heating circuit or a primary controller can be configured in the extra configuration.
- The plant type activates function block “Boiler sequence manager“ and function blocks “Boiler 1” and “Boiler 2”

Types of hydraulic circuit

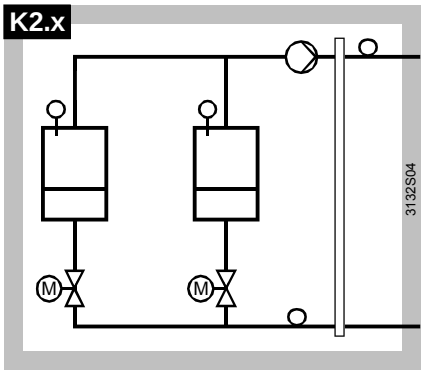
K

Basic type **K**; no preconfigured inputs and outputs

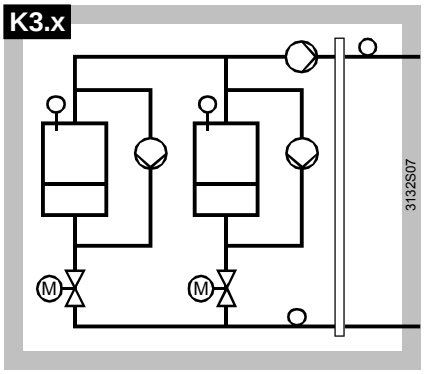
K1.x

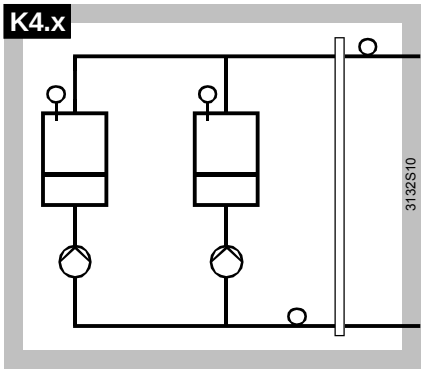


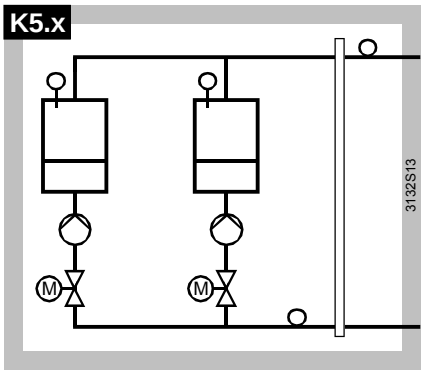
K2.x

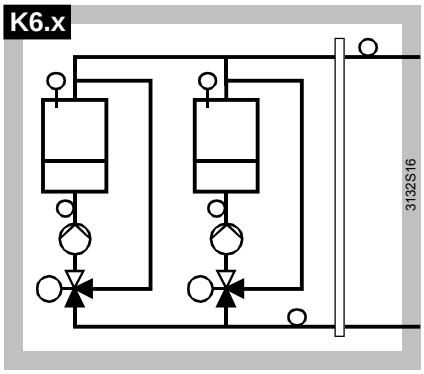


K3.x




K4.x
3132S10


K5.x
M
M
3132S13


K6.x
3132S16

Plant types and module assignment

Plant type		Controller	Extension modules		
		RMK770	RMZ789	RMZ787	RMZ789(2)
With main pump, no shutoff valve, no boiler pump					
K1.1	1-stage burner	✓			
K1.2	2-stage burner	✓			
K1.3	Modulating burner, 3-position	✓	✓		
With main pump, with shutoff valve, no boiler pump					
K2.1	1-stage burner	✓			
K2.2	2-stage burner	✓			
K2.3	Modulating burner, 3-position	✓	✓		
With main pump, with shutoff valve, with boiler pump in the bypass					
K3.1	1-stage burner	✓			
K3.2	2-stage burner	✓		✓	
K3.3	Modulating burner, 3-position	✓	✓		
No main pump, no shutoff valve, with boiler pump					
K4.1	1-stage burner	✓			
K4.2	2-stage burner	✓			
K4.3	Modulating burner, 3-position	✓	✓		
No main pump, with shutoff valve, with boiler pump					
K5.1	1-stage burner	✓			
K5.2	2-stage burner	✓		✓	
K5.3	Modulating burner, 3-position	✓	✓		
No main pump, maintained boiler return temperature with mixing valve, boiler pump					
K6.1	1-stage burner	✓	✓		
K6.2	2-stage burner	✓	✓		
K6.3	Modulating burner, 3-position	✓	✓		✓

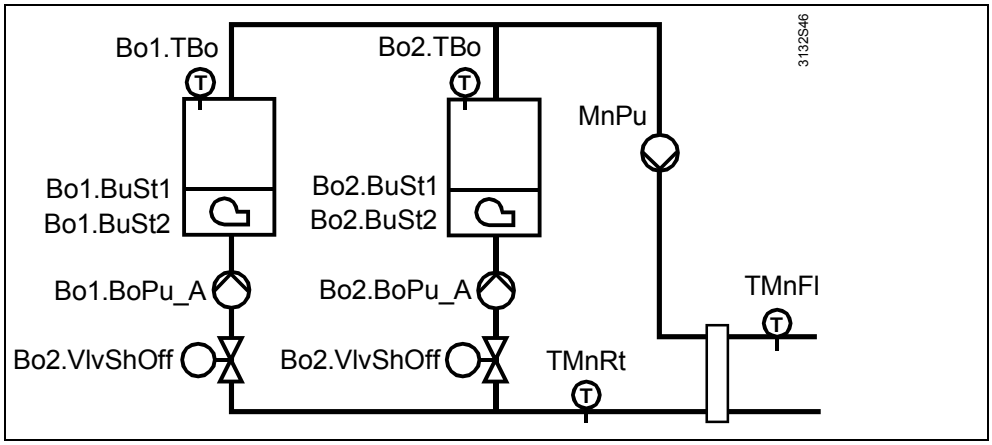
Assignment of sensors

With the plant types, the main flow and main return temperature sensors as well as the boiler temperature sensor are always preconfigured. With plant type K6.x, the boiler return temperature sensors are also preconfigured.
A main flow temperature is mandatory with all types of application. If there is no main flow sensor, the measured value can be adopted inside the controller from the boiler sensor of the current lead boiler.
The other sensors can be removed from the extra configuration, except in the case of modulating burners where a boiler temperature sensor is always required.

Assignment of outputs

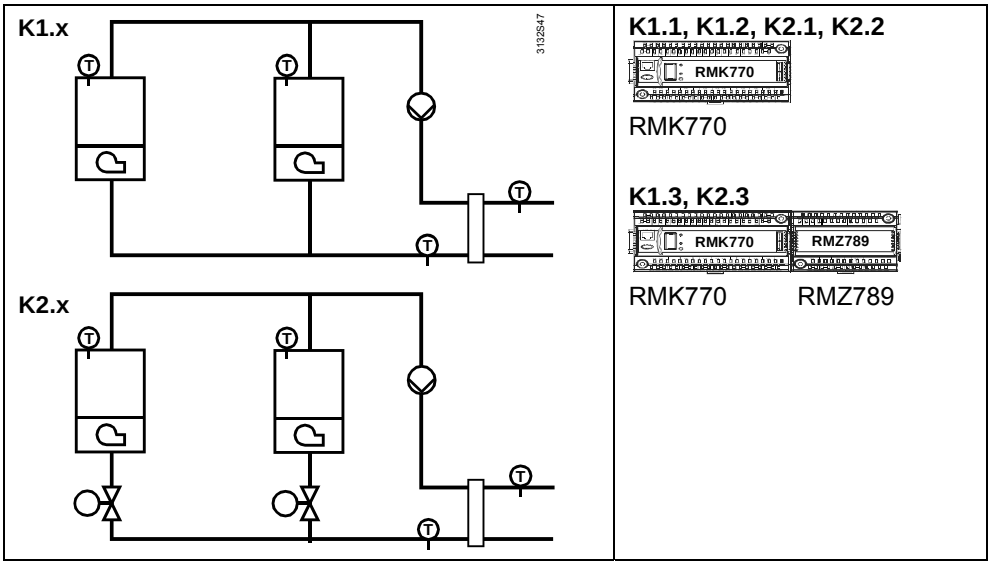
The shutoff valves are always preconfigured to outputs with changeover contacts so that on/off signals are available.
The on/off signals for modulating burners or for the mixing valve of the boiler return temperature are preconfigured to outputs that can be used with RC units to ensure suppression of radio interference.

The table below gives a summary of the plant types including the preconfiguration. The following designations are used for the inputs and outputs.



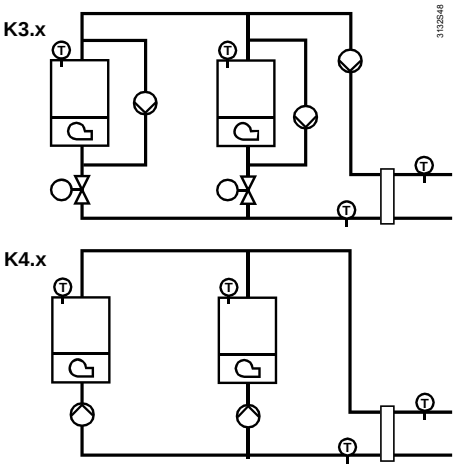
TMnFl	Main flow temperature sensor
TMnRt	Main return temperature sensor
Bo1.TBo	Boiler 1, boiler temperature sensor
Bo1.TRtBo	Boiler 1, boiler return temperature sensor
Bo2.TBo	Boiler 2, boiler temperature sensor
Bo2.TRtBo	Boiler 2, boiler return temperature sensor
Bo1.BoPu	Boiler 1, boiler pump
Bo1.BuSt1	Boiler 1, burner stage 1
Bo1.BuSt2	Boiler 1, burner stage 2
Bo1.BuMdltUp	Boiler 1, modulating burner on
Bo1.BuMdltDn	Boiler 1, modulating burner off
Bo1.VlvRTMxUp	Boiler 1, return mixing valve open
Bo1.VlvRTMxDn	Boiler 1, return mixing valve closed
Bo1.VlvShOf	Boiler 1, shutoff valve
Bo2.x	Boiler 2, x
MnPu	Main pump

Plant types
K1.x and K2.x

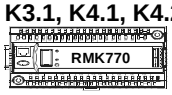


Connection terminals	*Plant type*					
	K1.1	*K1.2*	*K1.3*	*K2.1*	*K2.2*	*K2.3*
RMK770.X1	TMnFl	TMnFl	TMnFl	TMnFl	TMnFl	TMnFl
RMK770.X2	TMnRt	TMnRt	TMnRt	TMnRt	TMnRt	TMnRt
RMK770.X3	Bo1.TBo	Bo1.TBo	Bo1.TBo	Bo1.TBo	Bo1.TBo	Bo1.TBo
RMK770.X4						
RMK770.X5						
RMK770.X6	Bo2.TBo	Bo2.TBo	Bo2.TBo	Bo2.TBo	Bo2.TBo	Bo2.TBo
RMK770.X7						
RMK770.X8						
RMK770.D1						
RMK770.D2						
RMK770.Y1						
RMK770.Y2						
RMK770.Q1(U)				Bo1.VlvShOf	Bo1.VlvShOf	Bo1.VlvShOf
RMK770.Q2	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1
RMK770.Q3		Bo1.BuSt2			Bo1.BuSt2	
RMK770.Q4(U)				Bo2.VlvShOf	Bo2.VlvShOf	Bo2.VlvShOf
RMK770.Q5	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1
RMK770.Q6		Bo2.BuSt2			Bo2.BuSt2	
RMK770.Q7	MnPu	MnPu	MnPu	MnPu	MnPu	MnPu
RMZ789(1).X1						
RMZ789(1).X2						
RMZ789(1).X3						
RMZ789(1).X4						
RMZ789(1).Q1(U)			Bo1.BuMdltUp			Bo1.BuMdltUp
RMZ789(1).Q2			Bo1.BuMdltDn			Bo1.BuMdltDn
RMZ789(1).Q3			Bo2.BuMdltUp			Bo2.BuMdltUp
RMZ789(1).Q4(U)			Bo2.BuMdltDn			Bo2.BuMdltDn

Plant types
K3.x and K4.x

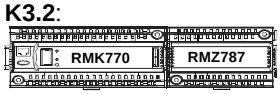


K3.1, K4.1, K4.2:



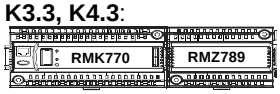
RMK770

K3.2:



RMK770 RMZ787

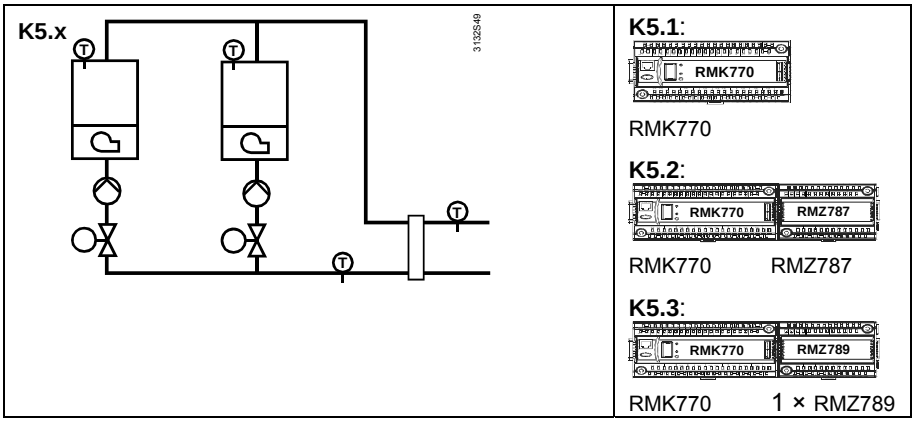
K3.3, K4.3:



RMK770 RMZ789

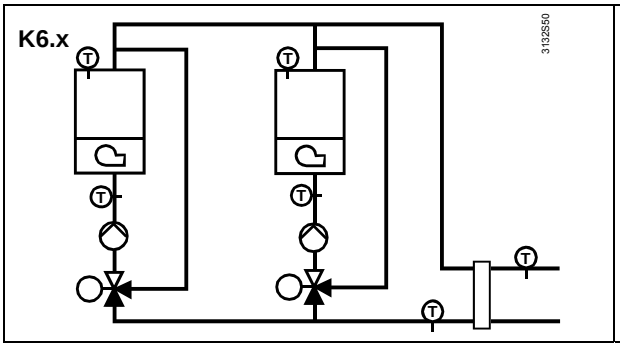
Connection terminals	*Plant type*					
	K3.1	*K3.2*	*K3.3*	*K4.1*	*K4.2*	*K4.3*
RMK770.X1	TMnFl	TMnFl	TMnFl	TMnFl	TMnFl	TMnFl
RMK770.X2	TMnRt	TMnRt	TMnRt	TMnRt	TMnRt	TMnRt
RMK770.X3	Bo1.TBo	Bo1.TBo	Bo1.TBo	Bo1.TBo	Bo1.TBo	Bo1.TBo
RMK770.X4						
RMK770.X5						
RMK770.X6	Bo2.TBo	Bo2.TBo	Bo2.Tbo	Bo2.TBo	Bo2.TBo	Bo2.TBo
RMK770.X7						
RMK770.X8						
RMK770.D1						
RMK770.D2						
RMK770.Y1						
RMK770.Y2						
RMK770.Q1(U)	Bo1.VlvShOf	Bo1.VlvShOf	Bo1.VlvShOf	Bo1.BoPu	Bo1.BoPu	Bo1.BoPu
RMK770.Q2	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1
RMK770.Q3	Bo1.BoPu	Bo1.BuSt2	Bo1.BoPu		Bo1.BuSt2	
RMK770.Q4(U)	Bo2.VlvShOf	Bo2.VlvShOf	Bo2.VlvShOf	Bo2.BoPu	Bo2.BoPu	Bo2.BoPu
RMK770.Q5	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1
RMK770.Q6	Bo2.BoPu	Bo2.BuSt2	Bo2.BoPu		Bo2.BuSt2	
RMK770.Q7	MnPu	MnPu	MnPu			
RMZ787(1).X1						
RMZ787(1).X2						
RMZ787(1).X3						
RMZ787(1).X4						
RMZ787(1).Q1		Bo1.BoPu				
RMZ787(1).Q2		Bo2.BoPu				
RMZ787(1).Q3						
RMZ787(1).Q5(U)						
RMZ789(1).X1						
RMZ789(1).X2						
RMZ789(1).X3						
RMZ789(1).X4						
RMZ789(1).Q1(U)			Bo1.BuMdltUp			Bo1.BuMdltUp
RMZ789(1).Q2			Bo1.BuMdltDn			Bo1.BuMdltDn
RMZ789(1).Q3			Bo2.BuMdltUp			Bo2.BuMdltUp
RMZ789(1).Q4(U)			Bo2.BuMdltDn			Bo2.BuMdltDn

Plant type K5.x

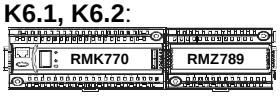


Connection terminals	*Plant type*		
	K5.1	*K5.2*	*K5.3*
RMK770.X1	TMnFl	TMnFl	TMnFl
RMK770.X2	TMnRt	TMnRt	TMnRt
RMK770.X3	Bo1.TBo	Bo1.TBo	Bo1.TBo
RMK770.X4			
RMK770.X5			
RMK770.X6	Bo2.TBo	Bo2.TBo	Bo2.TBo
RMK770.X7			
RMK770.X8			
RMK770.D1			
RMK770.D2			
RMK770.Y1			
RMK770.Y2			
RMK770.Q1(U)	Bo1.VlvShOf	Bo1.VlvShOf	Bo1.VlvShOf
RMK770.Q2	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1
RMK770.Q3	Bo1.BoPu	Bo1.BuSt2	Bo1.BoPu
RMK770.Q4(U)	Bo2.VlvShOf	Bo2.VlvShOf	Bo2.VlvShOf
RMK770.Q5	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1
RMK770.Q6	Bo2.BoPu	Bo2.BuSt2	Bo2.BoPu
RMK770.Q7			
RMZ787(1).X1			
RMZ787(1).X2			
RMZ787(1).X3			
RMZ787(1).X4			
RMZ787(1).Q1		Bo1.BoPu	
RMZ787(1).Q2		Bo2.BoPu	
RMZ787(1).Q3			
RMZ787(1).Q5(U)			
RMZ789(1).X1			
RMZ789(1).X2			
RMZ789(1).X3			
RMZ789(1).X4			
RMZ789(1).Q1(U)			Bo1.BuMdltUp
RMZ789(1).Q2			Bo1.BuMdltDn
RMZ789(1).Q3			Bo2.BuMdltUp
RMZ789(1).Q4(U)			Bo2.BuMdltDn

Plant type K6.x

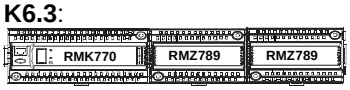


K6.1, K6.2:



RMK770 RMZ789

K6.3:



RMK770 2 × RMZ789

Connection terminals	*Plant types*		
	K6.1	*K6.2*	*K6.3*
RMK770.X1	TMnFl	TMnFl	TMnFl
RMK770.X2	TMnRt	TMnRt	TMnRt
RMK770.X3	Bo1.TBo	Bo1.TBo	Bo1.TBo
RMK770.X4	Bo1.TRtBo	Bo1.TRtBo	Bo1.TRtBo
RMK770.X5			
RMK770.X6	Bo2.TBo	Bo2.TBo	Bo2.TBo
RMK770.X7	Bo2.TRtBo	Bo2.TRtBo	Bo2.TRtBo
RMK770.X8			
RMK770.D1			
RMK770.D2			
RMK770.Y1			
RMK770.Y2			
RMK770.Q1(U)	Bo1.BoPu	Bo1.BoPu	Bo1.BoPu
RMK770.Q2	Bo1.BuSt1	Bo1.BuSt1	Bo1.BuSt1
RMK770.Q3		Bo1.BuSt2	
RMK770.Q4(U)	Bo2.BoPu	Bo2.BoPu	Bo2.BoPu
RMK770.Q5	Bo2.BuSt1	Bo2.BuSt1	Bo2.BuSt1
RMK770.Q6		Bo2.BuSt2	
RMK770.Q7			
RMZ789(1).X1			
RMZ789(1).X2			
RMZ789(1).X3			
RMZ789(1).X4			
RMZ789(1).Q1(U)	Bo1.VlvRtMxUp	Bo1.VlvRtMxUp	Bo1.BuMdltUp
RMZ789(1).Q2	Bo1.VlvRtMxDn	Bo1.VlvRtMxDn	Bo1.BuMdltDn
RMZ789(1).Q3	Bo2.VlvRtMxUp	Bo2.VlvRtMxUp	Bo1.VlvRtMxUp
RMZ789(1).Q4(U)	Bo2.VlvRtMxDn	Bo2.VlvRtMxDn	Bo1.VlvRtMxDn
RMZ789(2).X1			
RMZ789(2).X2			
RMZ789(2).X3			
RMZ789(2).X4			
RMZ789(2).Q1(U)			Bo2.BuMdltUp
RMZ789(2).Q2			Bo2.BuMdltDn
RMZ789(2).Q3			Bo2.VlvRtMxUp
RMZ789(2).Q4(U)			Bo2.VlvRtMxDn

3.3.2 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

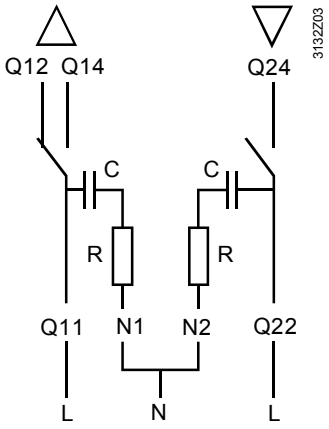
When controlling a shutoff valve, an on/off signal is usually required. For that purpose, a number of relays with changeover contacts are available.
In the case of the RMK770 and RMZ789, these are outputs Q1 and Q4; in the case of the RMZ787 and RMZ788, output Q5.

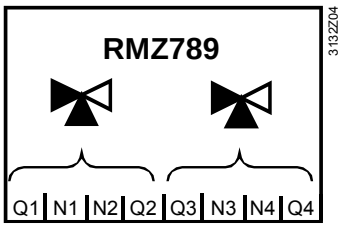
Terminals for 3-position control

The relay outputs for the on/off signal of 3-position control are assigned as pairs. The available terminals are the terminal pairs Q1/Q2, Q3/Q4 and Q5/Q6. Usually, special terminal pairs must be used.

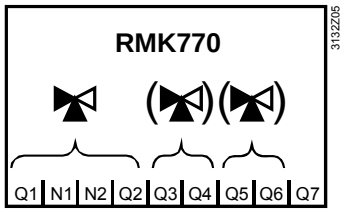
Outputs with RC units

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 RC units, appropriate devices must be provided either on the controller side or externally.
With the RMZ789 extension module, there are 4 mixing valve outputs available, where an RC unit can be easily activated.

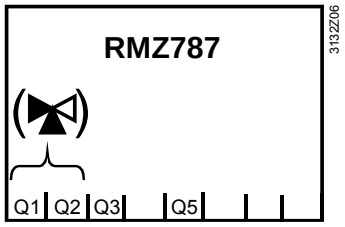


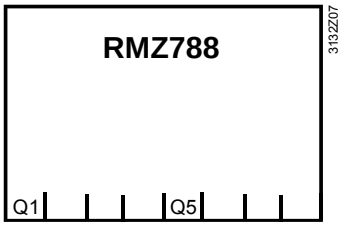


When terminals N1 and N2 or N3 and N4 of the extension module are interconnected and wired to N, the RC unit for outputs Q1/Q2 or Q3/Q4 is activated.



On the RMK770 basic unit, terminals Q1/Q2 can also be used for activating an RC unit. Outputs Q3/Q4 and Q5/Q6 can be configured as 3-position outputs but are not equipped with RC units.





With the extension modules RMZ787 and RMZ788, it is only output pair Q1/Q2 that can be used as a 3-position output, but this output is not equipped with RC units.

3.3.3 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 RMK770
A5	Extension module RMZ785
A7	Extension module RMZ787
A8	Extension module RMZ788
A9	Extension module RMZ789
A9(1)	First extension module RMZ789
A9(2)	Second extension module RMZ789

These short designations also appear o§ the display of the operator unit.

3.3.4 Maximum configuration

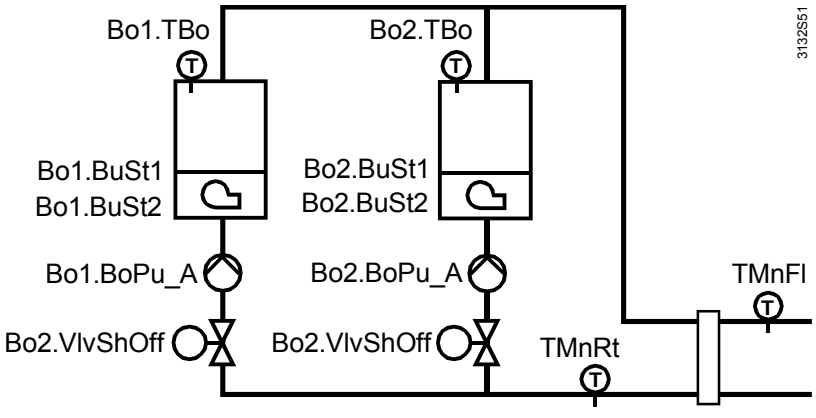
The configuration diagram in the Addendum gives an overview of the maximum number of function blocks that can be configured.

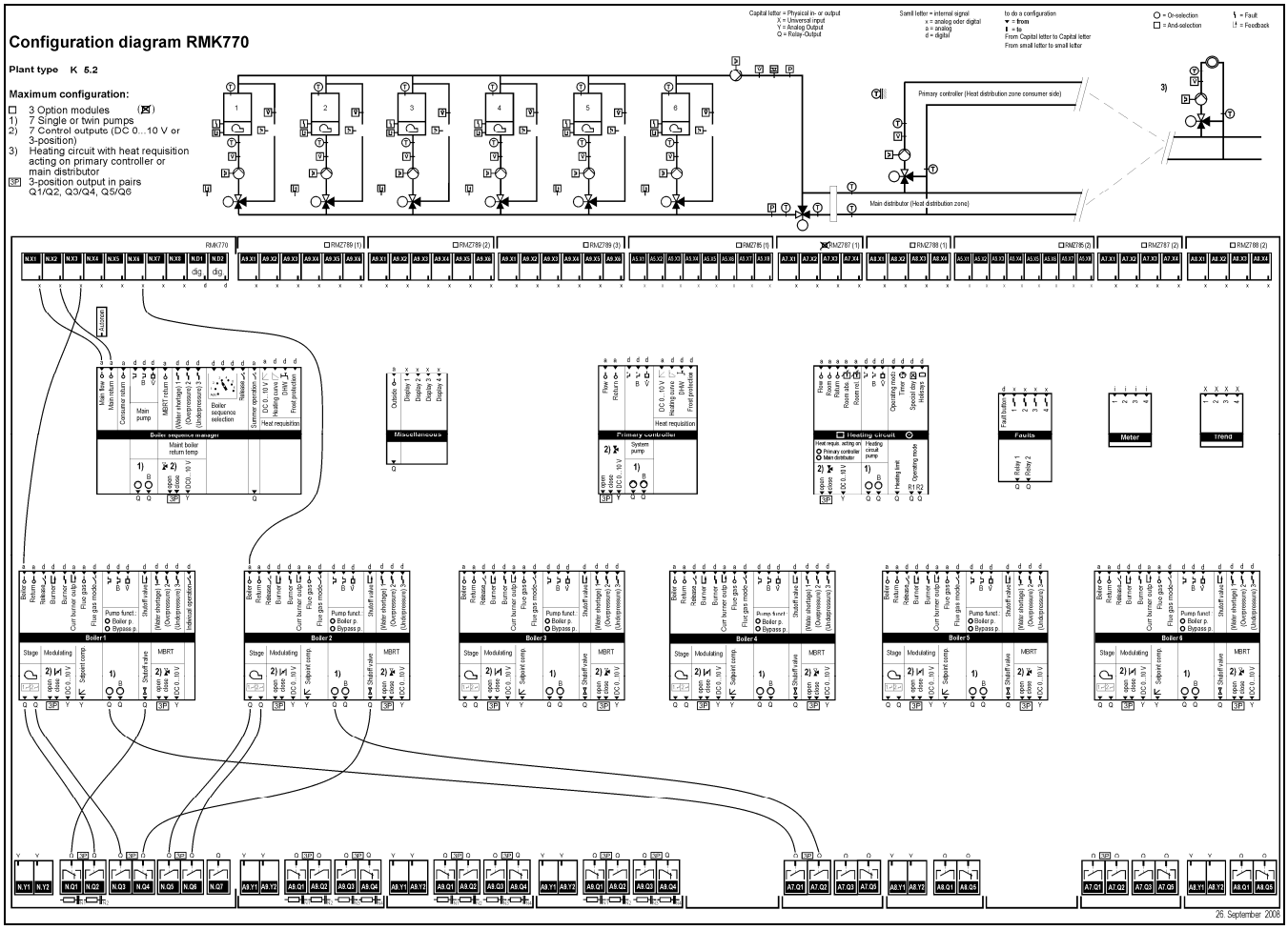
Quantity	*Type of function block*
1	Boiler sequence manager
6	Boiler
7	Output modulating (3-position or DC 0…10 V)
7	Pump block (for single or twin pumps)
1	Miscellaneous
1	Primary controller
1	Heating circuit
1	Faults

3.3.5 Use of configuration diagrams

Use of the configuration diagrams is explained on the basis of plant type K5.2.

Plant type K5.2





Function blocks

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

- Boiler sequence manager
- Boiler 1
- Boiler 2

Inputs and outputs

The configuration diagram shows the inputs and outputs that are preconfigured.
If required, additional inputs and outputs (e.g. flue gas temperature sensor, burner operation checkback signal) can be assigned to the free inputs and outputs in the extra configuration.

Extension modules

Also, it is possible to see which extension modules are required. For plant type K5.2, extension module RMZ787(1) is used as standard. This is shown on the Basic configuration menu, operating line "Position 1".
If required, the output for the first or the second boiler pump can also be configured to some other output. It is also possible to change the type of extension module.
On function block “Boiler sequence manager“, the main flow temperature sensor (N.X1) and the main return temperature sensor (N.X2) are preconfigured.
This can be checked on Extra configuration > Boiler sequence manager > Inputs.

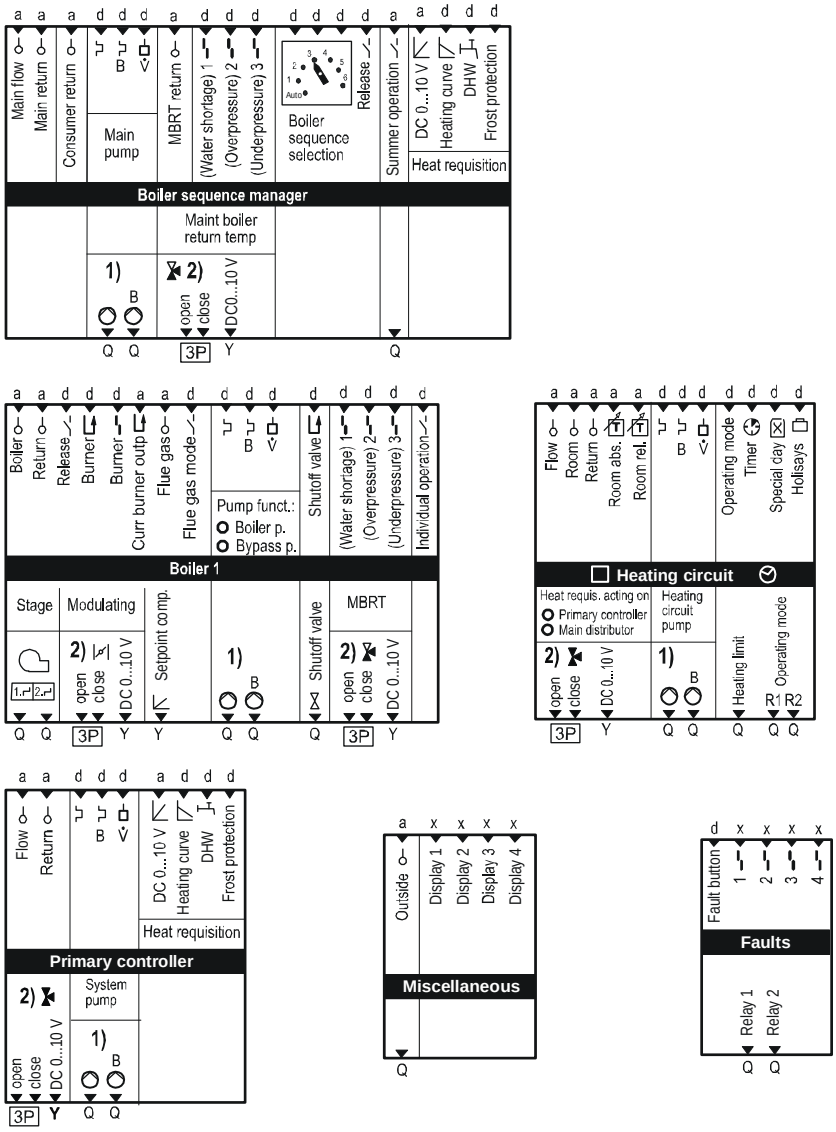
On function block “Boiler 1“, the boiler temperature sensor is configured to terminal N.X3. The burner is preconfigured to outputs N.Q2 and N.Q3, the boiler pump to A7.Q1, and the shutoff valve to the relay with changeover contact N.Q1.

For boiler 2 – analogously – N.X6 is preconfigured for the boiler temperature sensor, N.Q5 and N.Q6 for the 2-stage burner, N.Q4 for the shutoff valve, and A7.Q2 for the boiler pump.
This can be checked on Extra configuration > Boiler 1 (or **B**oiler 2) > Inputs (or **O**utputs).

It is possible to reconfigure or remove preconfigured inputs and outputs. If, for example, the second burner stage is removed from boiler 1 (--- in place of N.Q3), the burner of boiler 1 becomes a 1-stage burner.

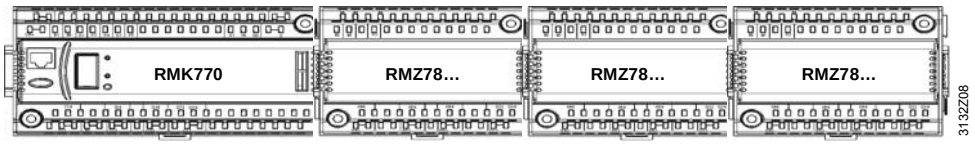
Further function blocks can be activated via the extra configuration.

Function blocks



More detailed information about these function blocks is provided in the following subsections.

3.3.6 Extension modules



A maximum of 3 extension modules per RMK770 can be used.

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 accord with the settings made on the controller.
When selecting the plant type, an extension module is automatically preconfigured, if required. This can be changed in the basic configuration.

Number of extension modules

A maximum of 3 extension modules can be fitted. The number of extension modules of the same type is not limited.

Assignment of functions

The assignment of functions to the basic module and the extension modules is not prescribed.
With the plant types, the temperature sensors are always preconfigured to the basic module as standard.
Relay outputs for 3-position applications are preconfigured to extension modules with the possibility of using RC units (RMZ789).

The following types of extension module can be connected to every RMK770:

- Universal module RMZ785 with 8 inputs
- Universal module RMZ787 with 4 inputs and 4 relay outputs (1 relay with changeover contact)
- Universal module RMZ788 with 4 inputs, 2 modulating outputs and 2 relay outputs (1 relay with changeover 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.

Example

	Position 1	Position 2
RMK770	**RMZ788**	**RMZ787**

The settings are to be made as follows:

Configuration example

Main menu > Commissioning > Basic configuration

Operating line	*Adjustable values / remarks*
Plant type	Basic types K, K1.1…K6.3
Position 1	RMZ788
Position 2	RMZ787

Position 1

At position 1, in this example, extension module RMZ788 is selected.

Position 2

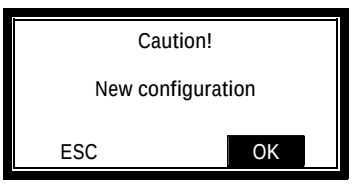
Then, at position 2, module RMZ787 is selected.

Position 3

Position 3 is not be used. It is left blank by using setting --- and by confirming with the OK knob.

⚠

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 continued until the following message appears:



If the maximum number of extension modules do not suffice, one or several boilers must be wired to a second RMK770 (for more detailed information, refer to section 3.5 “Several boiler sequence controllers RMK770”).

Fault handling

If the extension modules actually used and their positions do not agree with the values on the controller list, a fault status message ”Fault extension module” is 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 present 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 blink. If everything works correctly, the LEDs are lit.

3.4 Extra configuration

By configuring additional inputs and outputs, adaptations to the hydraulic circuit can be made, and extra functions and function blocks can be activated.
By selecting a plant type, function blocks “Boiler sequence manager”, “Boiler 1” and “Boiler 2” are activated (refer to subsection 3.3.5 “Use of configuration diagrams”).
The relevant function block is automatically activated when configuring an input or output.
Plant hydraulics is defined by the basic configuration and the extra configuration of plant components such as pumps, mixing valves, etc. In most cases, the configured outputs determine the plant’s hydraulic circuit.
Additional inputs and outputs can activate various functions. A description of these extra configurations is given with the relevant function block.

Example of flue gas temperature sensor

Main menu > Commissioning > Extra configuration > Boiler 1 > Inputs

Operating line	*Range*	*Factory setting*
Flue gas temperature sensor	RMK770…, RMZ7…*	---

* Here, the free outputs are available

The inputs on the basic module are designated RMK770.Xn, those on the extension modules RMZ…Xn. If 2 identical extension modules are used, they are called RMZ789(1) and RMZ789(2).
After the assignment, following appears: “Flue gas temperature sensor N.X4“ (N= short designation of basic module RMK770).
By assigning input terminal RMK770.X4, the flue gas temperature sensor is activated.
For other settings, refer to chapter 7 “Boiler control”.
Assignments made or preconfigured assignments can be removed again by using setting --- (none).

Example of common maintained boiler return temperature

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Outputs

Operating line	*Range*	*Factory setting*
Maint boiler return temp 3-pos	RMK770…, RMZ7…*	---

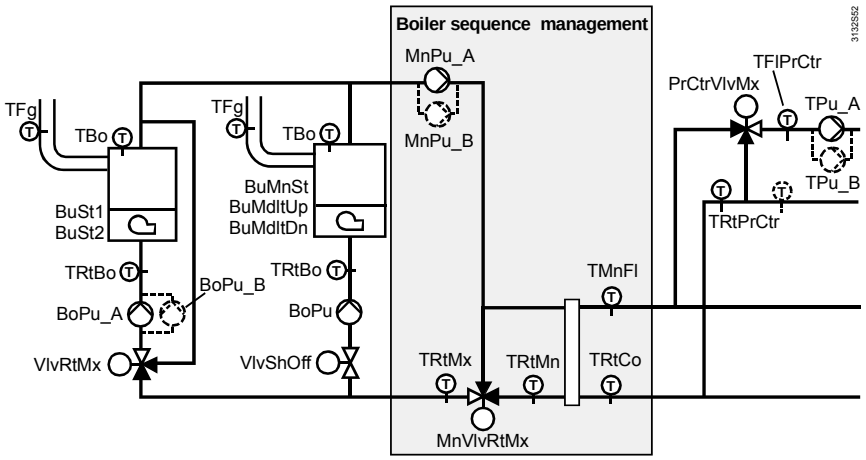
* Here, the free outputs are available for selection

Available for selection are the free terminal pairs (Q1/Q2, Q3/Q4, Q5/Q6) for the on and off signal (refer to subsection 3.3.2 “Terminal assignment and properties of outputs”).

Maximum plant size

Refer to subsection 3.3.4 ”Maximum configuration”.

3.4.1 Hydraulics-dependent inputs and outputs of function block “Boiler sequence manager”



The sensors and actuating devices in the highlighted part belong to function block “Boiler sequence manager”.
The relevant plant components are activated by making an assignment to an input or output terminal.

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs

Operating line	*Range*	*Name*
Main flow sensor	RMK770…, RMZ7…*	TMnFl**
Main return sensor		TMnRt**
Consumer return sensor		TRtCo
MBRT return sensor		TRtMx

* Here, the free inputs are available for selection
** These sensors are automatically configured when selecting the plant type (exception: Basic type K)

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Outputs

Operating line	*Range*	*Name*
Main pump	RMK770…, RMZ7…*	MnPu_A
Main pump B		MnPu_B
Maint boiler return temp 3-pos		MnVlvRtMx
Maint boiler return temp mod		MnVlvRtMx

* Here, the free inputs are available for selection

Main flow sensor (TMnFl)

The main flow temperature is the main controlled variable of the boiler sequence and must always be available with the boiler master (for more detailed information, refer to section 3.5 “Several boiler sequence controllers RMK770”).
If there is no main flow temperature sensor, the following configuration is used to adopt the measured value inside the controller from the boiler sensor of the current lead boiler:
Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs > Main flow sensor: autonomous
This variant can only be used with 2-boiler plant.

Main return sensor (TMnRt)

The main return temperature sensor is recommended for plant with pressureless headers.

MBRT return sensor (TRtMx)

The MBRT return temperature sensor is required for minimum limitation of the return temperature in connection with a common mixing valve (MnVlvRtMx). For this type of application, the TMnRt sensor cannot be used.
When there is no mixing valve for the common maintained boiler return temperature, the sensor for minimum limitation of the return temperature with action on the consumers can be used.
The sensor can also be used for display purposes.

Consumer return sensor (TRtCo)

The return sensor on the consumer side can be used for frost protection for the plant.

Main pump A (MnPu_A)

Common main pump A (the menu item does not show designation ”A“).

Main pump B (MnPu_B)

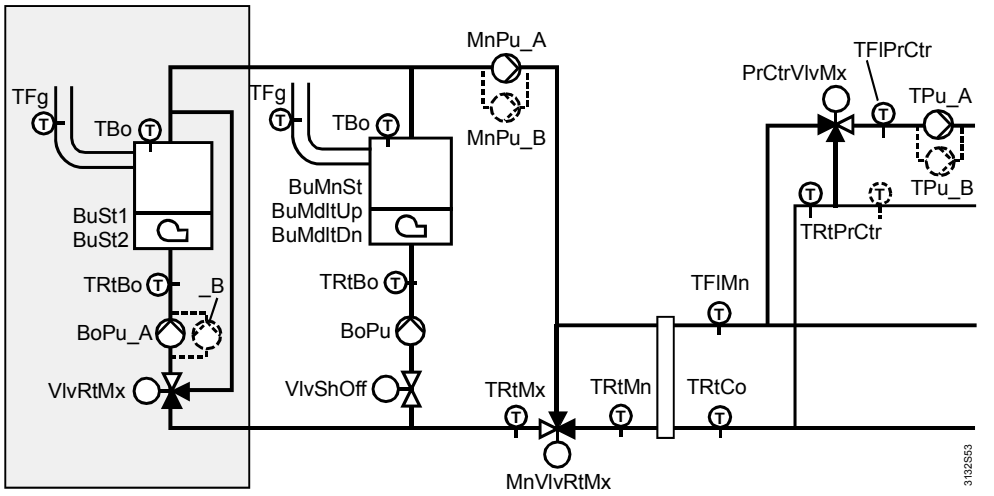
Common main pump B if the common main pump is a twin pump.

Maintained boiler return temperature (MnVlvRtMx)

Common 3-position or modulating mixing valve for minimum limitation of the boiler temperature (for restriction regarding the 3-position output, refer to subsection 3.3.2 “Terminal assignment and properties of outputs”).

For more detailed information, refer to chapter 6 “Boiler sequence management”.

3.4.2 Hydraulics-dependent inputs and outputs of function block “Boiler“



Main menu > Commissioning > Extra configuration > Boiler ... > Inputs

Operating line	*Range*	*Name*
Boiler sensor	RMK770…, RMZ7…*	TBo**
Return sensor		TrtBo
Flue gas temperature sensor		TFg

* Here, the free inputs are available for selection

** This sensor is automatically configured when selecting a plant type (exception: Basic type K)

Main menu > Commissioning > Extra configuration > Boiler ... > Outputs

Operating line	*Range*	*Name*
Burner stage 1	RMK770…, RMZ7…*	BuSt1
Burner stage 2		BuSt2
Modulating burner 3-pos		BuMdltUp
Modulating burner mod		BuMdlt
Setpoint compensation		BoSetpt
Boiler pump A		BoPu_A
Boiler pump B		BoPu_B
Pump function	Boiler / bypass pump	
Shutoff valve		VlvShOff
Maint boiler return temp 3-pos		VlvRtMx
Maint boiler return temp mod		VlVRtMx

* Here, the free outputs are available for selection

Boiler sensor (TBo)

The boiler temperature sensor is used as a control sensor for the boiler temperature setpoint. It is mandatory for minimum and maximum limitation of the boiler temperature and for modulating burners.

Return sensor (TRtBo)

The boiler return temperature sensor is used as a control sensor for maintained boiler return temperature with mixing valve.

Flue gas temperature sensor(TFg)

The flue gas temperature sensor is used for supervision of the flue gas temperature.

Burner stage 1 (BuSt1)

1st burner stage or basic stage for modulating burners.

Burner stage 2 (BuSt2)

2nd burner stage for modulating burners.

Modulating burner (BuMdltUp/Dn)

Modulating burner with 3-position or modulating control (for restriction with 3-position output, refer to subsection 3.3.2 “Terminal assignment and properties of outputs”).

Setpoint compensation (BoSetpt)

Compensation of boiler temperature setpoint DC 0…10 V for boilers with own boiler temperature control.

Boiler pump A (BoPu_A)

Boiler pump A, the pump’s function can be selected: Boiler pump or bypass pump.

Boiler pump B (BoPu_B)

Boiler pump B, if the boiler pump is a twin pump.

Shutoff valve (VlvShOff)

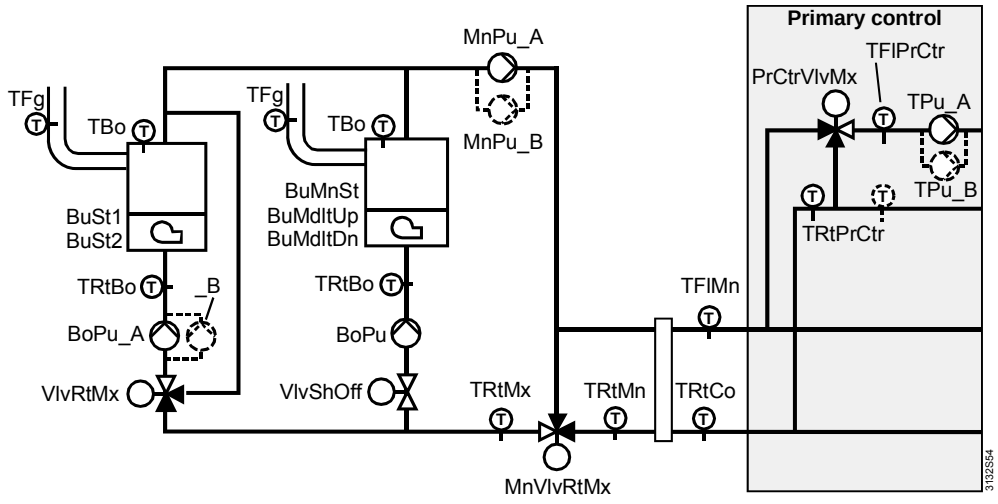
Shutoff valve.

Maintained boiler return temperature (VlVRtMx)

3-position or modulating mixing valve for maintained boiler return temperature (for restriction with 3-position output, refer to subsection 3.3.2 “Terminal assignment and properties of outputs”).

For more detailed information, refer to chapter 7 “Boiler control”.

3.4.3 Hydraulics-dependent inputs and outputs of function block “Precontrol“



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

Operating line	*Range*	*Name*
Flow sensor	RMK770…, RMZ7…*	TFlPrCtr
Return sensor		TRtPrCtr

* Here, the free inputs are available for selection

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

Operating line	*Range*	*Name*
Mixing valve 3-pos		PrCtrVlvMx
Mixing valve modulating		PrCtrVlvMx
System pump	RMK770…, RMZ7…*	TPu_A
System pump B		TPu_B

* Here, the free outputs are available for selection

Flow sensor (TFlPrCtr) Flow temperature sensor in the primary controller loop.

Return sensor (TRtPrCtr) Return temperature sensor in the primary controller loop.

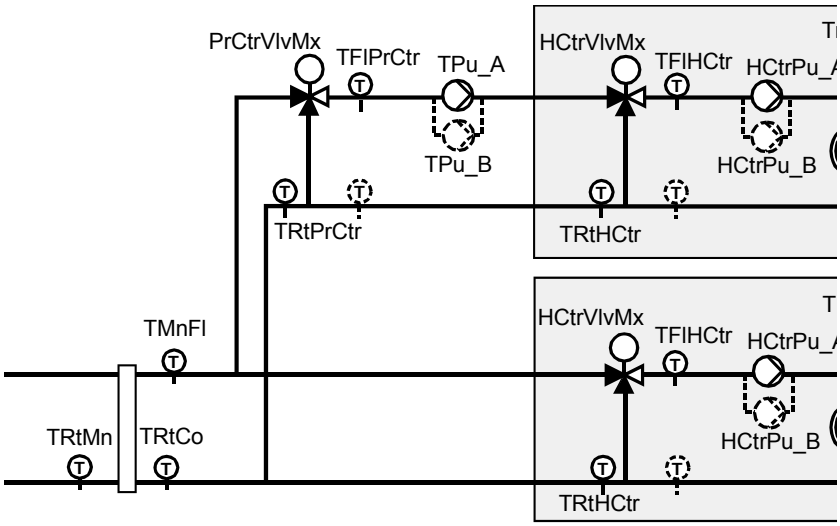
System pump A (TPu_A) System pump A (the menu item does not show designation ”A”).

System pump B (TPu_B) System pump B, if the system pump is a twin pump.

Mixing valve (PrCtrVlvMx) 3-position or modulating mixing valve for precontrol.

For more detailed information, refer to chapter 9 “Precontrol”.

3.4.4 Hydraulics-dependent inputs and outputs of function block “Heating circuit“



Main menu > Commissioning > Extra configuration > Heating circuit

Operating line	*Range*	*Factory setting*
Heat req heat circuit acting on	Main distributor / Primary controller	Main distributor

Main menu > Commissioning > Extra configuration > Heating circuit > Inputs

Operating line	*Range*	*Name*
Flow sensor	RMK770…, RMZ7…*	TFlHCtr
Room sensor		Tr
Return sensor		
Special day input		
Holiday input		

* Here, the free inputs are available for selection

Main menu > Commissioning > Extra configuration > Heating circuit > Outputs

Operating line	*Range*	*Name*
Mixing valve 3-pos		HCtrVlvMx
Mixing valve modulating		HCtrVlvMx
Heating circuit pump	RMK770…, RMZ7…*	HCtrPu
Heating circuit pump B		HCtrPu_B

* Here, the free outputs are available for selection

Virtual heating circuit

Function block “Heating circuit” can be used as a “virtual heating circuit“. It calculates a weather-compensated flow temperature setpoint, but does not deliver any output signals (hence, pump or mixing valve for the heating circuit is not a mandatory requirement!). The weather-compensated flow temperature setpoint is delivered to the main flow and acts as weather-compensated heat demand.
The setting to be selected is “Heating circuit active“; the heating circuit entries are made on the operator unit as usual. No output terminals are configured.

Real heating circuit

When a heating circuit pump and/or heating circuit mixing valve is/are configured, the heating circuit is automatically activated; a “real” heating circuit is created. In that case, setting “Heating circuit active/inactive“ is of no importance.

Heat req heat circuit acting on

This setting defines whether the heating circuit is “connected” directly to the main header or downstream from the primary controller.

Flow sensor (TFlPrCtr)

Flow temperature sensor

Room sensor (Tr)

Room temperature sensor

Return sensor (TRtPrCtr)

Return temperature sensor

Special day input

Digital input for activating the “Special day“ function.

Holidays input

Digital input for activating the “Holidays“ function.

Heating circuit pump A (HctrPu_A)

Heating circuit pump A (the menu item does show designation ”A”).

Heating circuit pump B (HCtrPu_B)

Heating circuit pump B, if the heating circuit pump is a twin pump

Mixing valve for heating circuit (HCtrVlVMx)

3-position or modulating mixing valve for the heating circuit

For more detailed information, refer to chapter 10 “Heating circuit control” .

3.4.5 Miscellaneous

Settings

At menu item Miscellaneous of the extra configuration, the following settings can be made:

Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs

Operating line	*Range*	*Name*
Outside sensor	RMK770…, RMZ7…*	
Display input 1		
Display input 2		
Display input 3		
Display input 4		

* Here, the free inputs are available for selection

Outside sensor

Here, an outside sensor can be configured. That sensor can be used for both the heating circuit and the boiler sequence manager.

Special day input

Digital input for activating the “Special day” function.

Holidays input

Digital input for activating the “Holidays” function.

Display inputs 1…4

Here, 4 universal inputs for display purposes can be configured.
The unit of these inputs can be defined at menu item Input identifier.

Main menu > Commissioning > Extra configuration > Input identifier

Operating line	*Range*	*Factory setting*
Display input 1	°C / % / g/kg / kJ/kg / W/m^2 / m/s / bar / mbar / Pa / ppm / Universal 000.0 / Universal 0000 / Digital	°C
Display input 2		°C
Display input 3		°C
Display input 4		°C

For resolution, type of sensor, etc., refer to subsection 3.4.7 “Configuration of the universal inputs and outputs”.

Outside temperature relay

Main menu > Commissioning > Extra configuration > Miscellaneous > Outputs

Operating line	*Range*	*Factory setting*
Outside temperature relay	RMK770…, RMZ7…*	

* Here, the free outputs are available for selection

Business card

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

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

For more detailed information, refer to chapter 12 “Function block “Miscellaneous“”.

3.4.6 Faults

Main menu > Commissioning > Extra configuration > Faults > Inputs

Operating line	*Range*	*Factory setting*
Fault button external	RMK770…, RMZ7…*	---
Fault input 1		---
Fault input 2		---
Fault input 3		---
Fault input 4		---

* Here, the free inputs are available for selection

Main menu > Commissioning > Extra configuration > Faults > Outputs

Operating line	*Range*	*Factory setting*
Fault relay 1	RMK770…, RMZ7…*	
Fault relay 2		

* Here, the free outputs are available for selection

For more detailed information, refer to chapter 13 “Function block “Faults“”.

3.4.7 Configuration of the universal inputs and outputs

The universal inputs can accept digital signals and passive or active analog signals. The inputs are activated via the basic and the extra configuration. Together with the activation, the unit is assigned to the relevant input. For this reason, setting the input identifier is not required with the RMK770 (with the exception of the 4 universal inputs for display purposes and the 4 fault inputs).

Analog inputs

With the analog inputs, the following settings can be made:

- Type
- Measuring range
- Measured value correction

Temperature sensor LG-Ni1000 is preselected as standard for all types of temperature sensors.

Type

The following types of input signals can be handled:

- LG-Ni1000
- 2 × LG-Ni1000
- T1
- Pt1000
- DC 0…10 V

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs > ...X...

Operating line	*Range*	*Factory setting*
Type	Ni1000 / 2×Ni1000 / T1 / Pt1000 / 0…10 V	Ni1000

Measuring range

- Passive temperature signals delivered by LG-Ni1000 sensing elements have a measuring range of −50…+250 °C
- Passive temperature signals delivered by 2 x LG-Ni1000 or T1 sensing elements have a measuring range of −50…+150 °C
- Passive temperature signals delivered by Pt1000 sensing elements have a measuring range of −50…+400 °C
- In the case of active signals, the measuring range can be selected. To be entered is a low and a high limit value.

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:
Low limit value: 0 °C
High limit value: 100 °C

Measured value correction

With a passive temperature sensor, the measured value can be readjusted by −3.0 to +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 "[…X…] sensor error" will be delivered.
If there is an open-circuit of the measuring line, the operator unit displays the measured value as: ----.
A short-circuit is displayed as: oooo.

Digital inputs

The digital inputs can accept signals from potential-free contacts for control functions.

Configuration of input

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

Operating line	*Setting*
N.X5	Digital

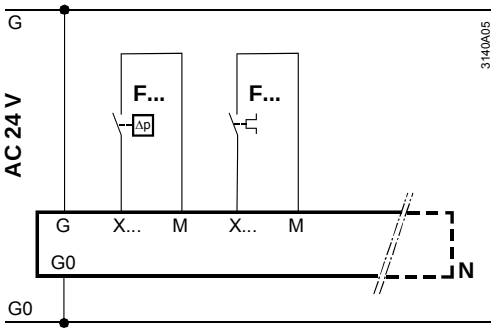
Normal position

The normal position can be predefined for each digital input.

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs > ...X...

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

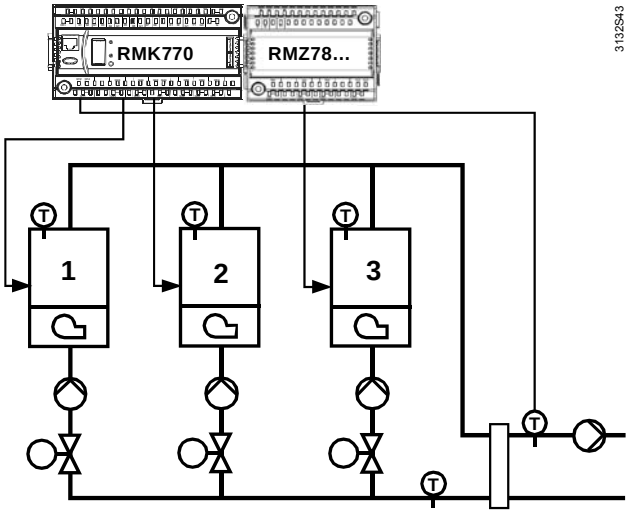


Fault handling

Digital signals cannot be monitored.

3.5 Several boiler sequence controllers RMK770

If the number of outputs do not suffice although all extension modules are fully used, or if the number of available function blocks do not suffice, the multiboiler plant must be assigned to several RMK770 controllers. But there may also be other reasons to have the plant controlled by several RMK770.
In that case, one of the RMK770 controllers provides the boiler master function. And function block “Boiler sequence manager” is activated only in that RMK770. This function block controls the boilers of the other RMK770 via bus.
The boiler master is defined by configuring the main flow temperature sensor.
With the other RMK770 controllers, that sensor must not be configured.
Configuration with the second RMK770 is made with setting “Basic type K“. In the extra configuration, the sensors and aggregates must be assigned to the relevant boiler. In the illustration below, this is boiler no. 3.



Common plant components (main pump, system pump, primary controller) must also be connected to the controller with the boiler master.

If in total more than two boilers are in operation, the number of boilers must be set on the boiler master.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager

Operating line	*Range*	*Factory setting*
Number of boilers	1…6	2

Communication

Communication between the 2 RMK770 takes place via KNX bus. It must be activated via the Communication menu. For more detailed information, refer to chapter 14 “Communication”.

3.6 Wiring test

A wiring test can be made with all connected peripheral devices. On completion of the configuration and after having made all settings, it is recommended to conduct this test.

Inputs

At the inputs, the current states or values are displayed.

Outputs

The aggregates (pumps, actuators, etc.) connected to the outputs can be switched.
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.

In the wiring test, the inputs and outputs are to be checked for the following faults:
- Wiring error, that is, wires have been mixed up
- Position fault, that is, wires of sensor or actuator have been mixed up
- Discrepancy between actual type of connection and controller configuration (e.g. LG-Ni1000 in place of DC 0…10 V)

Example with boiler 1

Main menu > Commissioning > Wiring test > Boiler 1 > Inputs

Operating line	*Remarks*
Actual value boiler temperature	Display of the current measured value

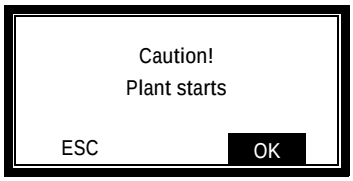
Main menu > Commissioning > Wiring test > Boiler 1 > Outputs

Operating line	*Positions*
Boiler pump	Off / On

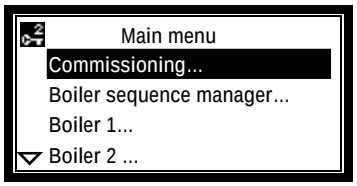
3.7 Completing commissioning

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

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



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



3.8 Data backup

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

Display values

Main menu > Data backup

Operating line	*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	*Remarks*
Restore	Caution! New configuration
Save	Caution! Stored data will be overwritten.

3.9 Device information

On the Device information menu, information about the controller, such as the software version, can be viewed.

Display values

Main menu > Device information > Controller

Operating line	*Remarks*
Plant type	Display of plant type
Plant type adapted	Display of an intervention made 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.
Device type	RMK770-…
Software version	Display of software version
Hardware version	Display of hardware version

■ Main menu > Device information > Position 1 or 2 or 3

Operating line	*Remarks*
Extension module	Display of the module's type reference
Software version	Display of software version
Hardware version	Display of hardware version

3.10 Leaving the password level

On completion of commissioning, select the user level (access level for the plant operator). To do this, proceed as follows:

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

3.11 Marking changes

Marking

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

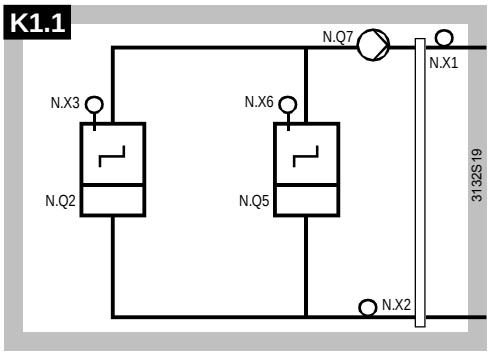
Resetting the marking

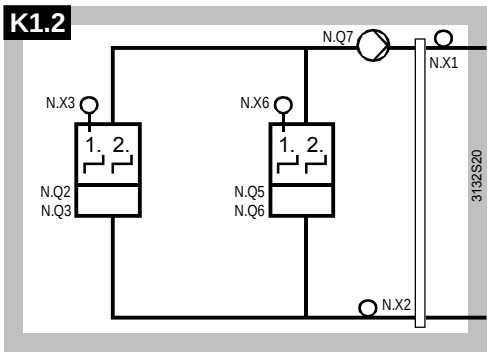
The asterisk is deleted and line "Plant type adapted" shows the value as "No" if, on the Basic configuration menu, the old or a new standard application is loaded for the plant type. A new configuration is made based on the selected application.

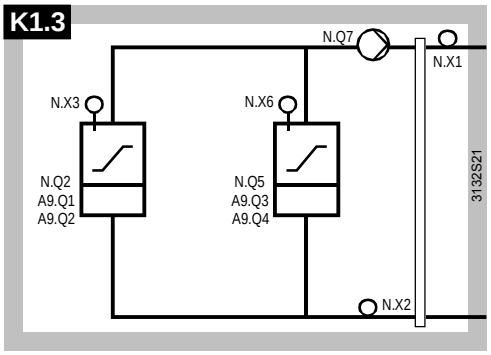
3.12 Plant types and default terminal assignments

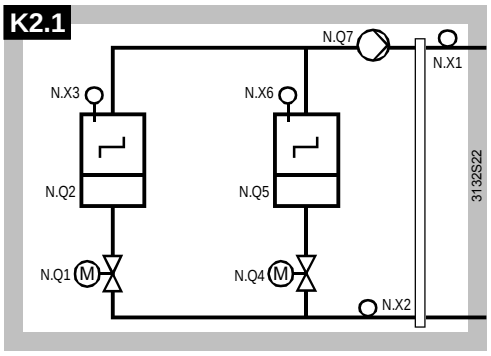
Note

The terminal markings used are explained at the end of this section.

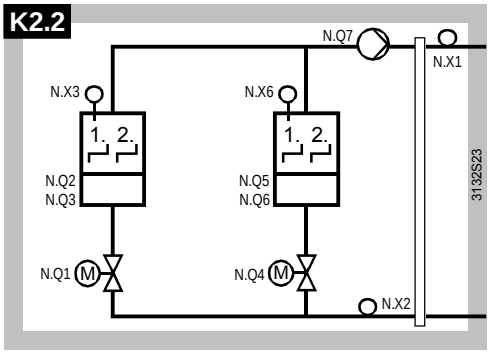




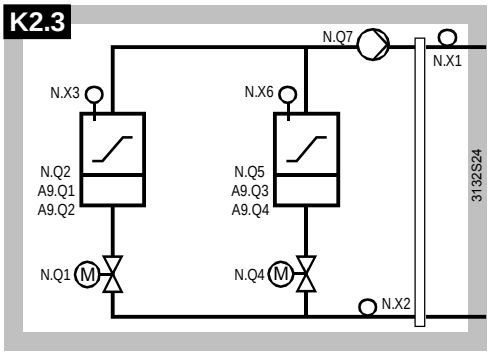




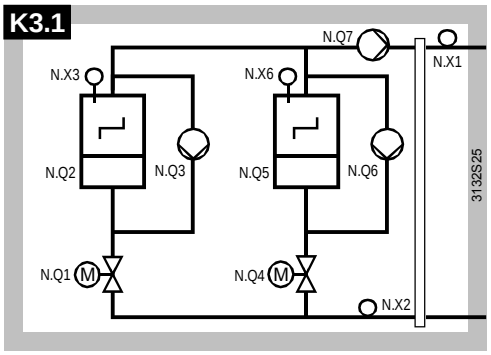
K2.2



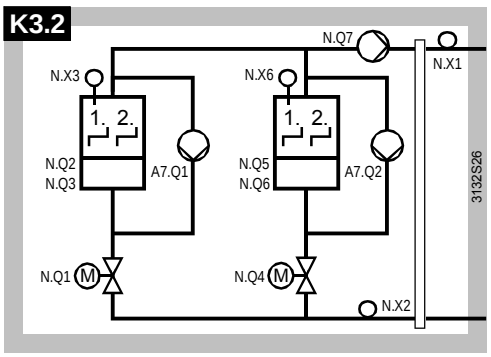
K2.3



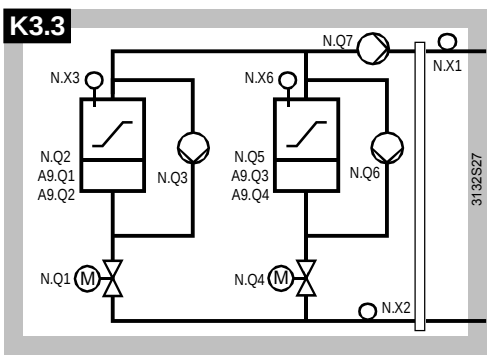
K3.1



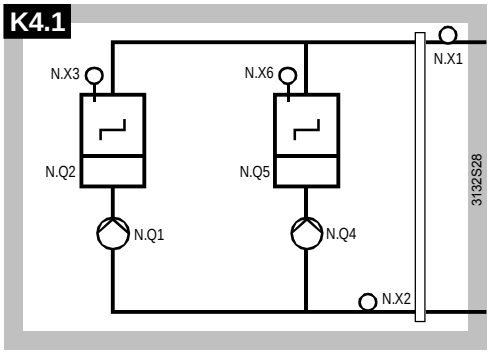
K3.2



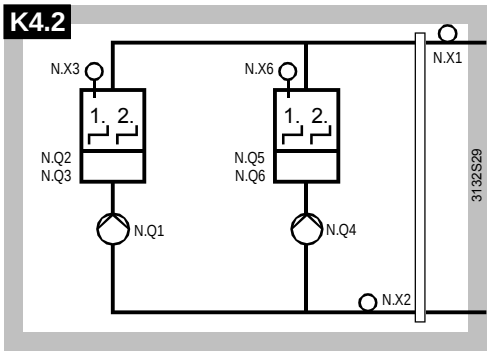
K3.3



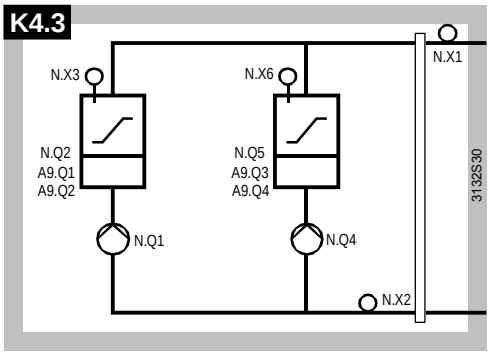
K4.1



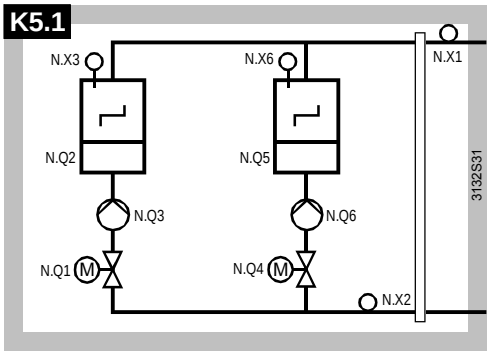
K4.2



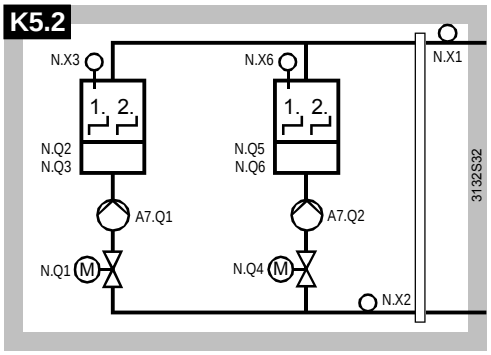
K4.3



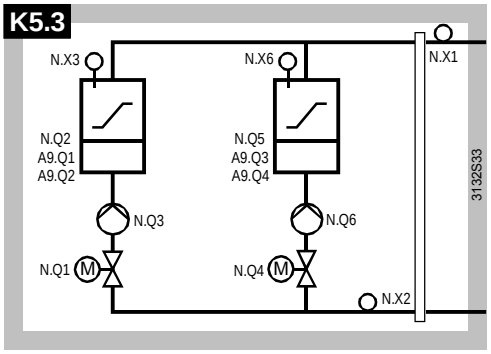
K5.1



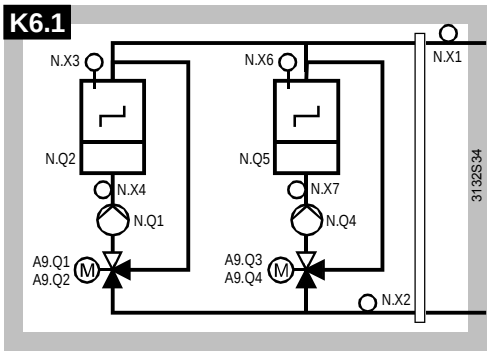
K5.2



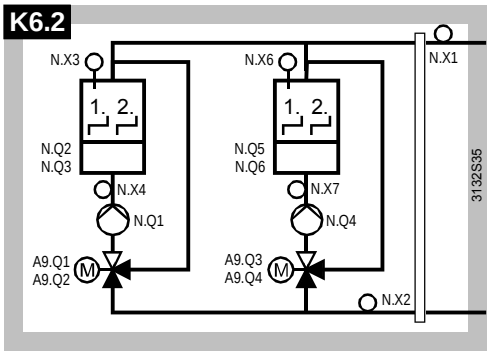
K5.3



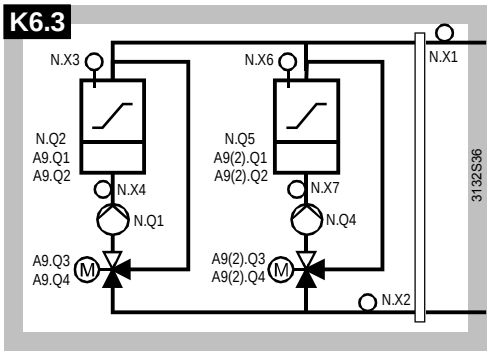
K6.1



K6.2



K6.3



Explanation of the terminal markings used:

	Boiler with 1-stage burner
	Boiler with 2-stage burner
	Boiler with modulating burner, 3-position
N	Connection terminal on the controller
X1	Configurable input at the controller
Q1	Relay with terminals Q11, Q12 and Q14
Q2	Relay with terminals Q23 and Q24
A7	Connection terminals on the RZM787 extension module
A9	Connection terminals on the first RZM789 extension module
A9(2)	Connection terminals on the second RZM789 extension module

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)	31.05.2004	hh:mm (hours: minutes)	15:56
am/pm	mm/dd/yy (day/month/year)	05/31/2004	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 adjusted should the relevant regulations change. The dates set for the change from wintertime to summertime, or 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 is inactive.

Setting

Main menu > Time of day/date

Operating line	*Range*	*Factory setting*
Summertime start	01.01. … 31.12	25.03
Wintertime 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.
The following settings for clock time operation are possible:

- Autonomous (does not send and does not receive)
- Time of day **via** bus: Clock time slave (receives the synchronization signal via bus)
- Time of day on the bus: Clock time master (sends the synchronization signal to the bus)

Settings

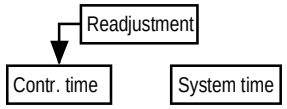
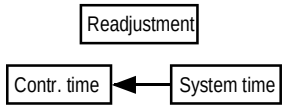
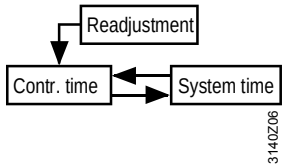
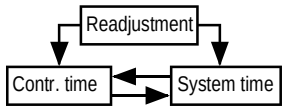
Main menu > Commissioning > Communication > Basic settings

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 remote settings for the clock time slave are possible:

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

The individual settings have the following impact:

Entry	*Effect*	*Diagram*
Autonomous	• The time of day on the controller can be adjusted • 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 adjusted • The controller's time of day is continuously and automatically matched to the system time	
Slave, remote setting clock slave Yes	• The controller's time of day can be adjusted and, at the same time, the system time is adjusted • 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, adjusts 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 is 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" is delivered.
In the event of a power failure, the clock has a reserve of 12 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" is delivered.
An invalid time of day blinks.

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 RMK770 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:

Product no.	*Language 1*	*Language 2*	*Language 3*	*Language 4*	*Language 5*	*Language 6*
RMK770-1	German	French	Italian	Spanish		
RMK770-2	German	English	French	Dutch		
RMK770-3	Swedish	Finnish	Norwegian	Danish		
RMK770-4	Polish	Czech	Slowakian	Hungarian	Russian	Bulgarian
RMK770-5	Serbian	Croatian	Rumanian	Slowenian	Greek	Turkish

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Device

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

* Available with all types

4.3 Selecting the unit of temperature

On the RMK770, 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 the operator unit's 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 entry

4.5.1 Device name and file name

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Texts

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

Device name

The text of the device name 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 here.

4.5.2 Aggregate names

Aggregates boiler 1…6, primary controller, heating circuit and time switch can be given dedicated names. The setting is made on the relevant aggregate.

Setting (example for boiler 1)

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler 1

Operating line	*Range*	*Factory setting*
Boiler 1	Max. 20 characters	

Here, text with a maximum of 20 characters can be entered. This designation is then used on the info pages and by the menus. Only in the extra configuration and in the wiring test will the original designation boiler 1 continue to be used.

4.5.3 Text of fault inputs

The texts for the fault inputs are locally displayed as fault texts and are also transmitted via bus.
In addition to the predefined fault inputs, there are 4 universal fault inputs and 3 digital aggregate-related fault inputs available. The text for the universal fault inputs can be edited on Main menu > Settings > Faults, the text for the aggregate-related faults at the relevant aggregate, e.g. Settings > Boiler 1 > Fault settings.

Setting (example for fault input 1)

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 text	Max. 20 characters	[Fault input 2] Fault
Fault text	Max. 20 characters	[Fault input 3] Fault
Fault text	Max. 20 characters	[Fault input 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 must be activated in the extra configuration.

Settings

Main menu > Commissioning > Extra configuration > Miscellaneous

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 line 1…4

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

Main menu > Settings > Texts

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

5 General functions, fundamentals

5.1 Time switch

A time switch is available for the heating circuit. In “Automatic” mode, the heating circuit, operates according to that time switch. A switching program can be defined for each day of week.
Using the program entered, the time switch controls the change of operating modes and the associated setpoints.
Operation of the time switch is described in the Operating Instructions (B3133x…).

5.1.1 Communication

If the controller is connected to other controllers via communication, the time switch can be provided to other controllers, or the time switch of some other Synco™ 700 controller can be used.

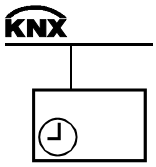
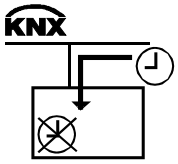
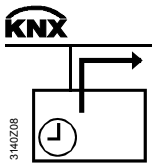
Settings

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

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

.

Following combinations are possible:

Entry	*Effect*	*Diagram*
Autonomous	Time switch only acts locally on this controller. It has no impact on other controllers on the bus.	
Slave	The time switch of this controller is not active. Active is an external time switch which can be selected by setting the time switch reception zone. Each time switch only acts in its own zone and each zone has only 1 time switch. The external time switch must be set as the time switch master.	
Master	The time switch of this controller is active. It acts on all other controllers located in the same zone. The zone must be set on both the master and the slaves. The receivers must be set as slaves.	

Main menu > Commissioning > Communication > Room Heating circuit

Operating line	*Range*	*Factory setting*
Geographical zone (apartment)	---- / 1…126	----
Time switch slave (apartment)	---- / 1…126	----
Time switch operation	Autonomous / Slave / Master	Display only

5.1.2 Entering the 24-hour program for space heating

For space heating, an individual 24-hour program can be selected for every day.

Space heating

■ Main menu > Heating circuit > Time switch

Operating line		*Factory setting*
Monday through Sunday	Comfort / Precomfort / Economy	06:00 Comfort 22:00 Economy
Special day	Comfort / Precomfort / Economy	06:00 Comfort 22:00 Economy

The special day is a 24-hour program that can be activated either via the holidays program or an external contact.
Activation of the special day is described in section 5.2 “Holidays / special days”.

No signal

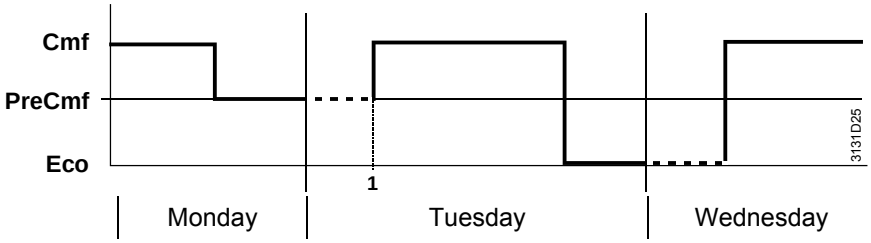
If the controller anticipates a time switch signal via bus, but the signal is not sent, the controller operates in ”Comfort“ mode and fault status message System time switch failure 1 is delivered.

Entries

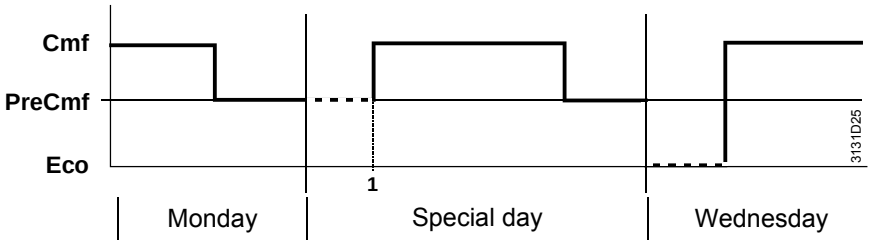
For each day, a maximum of 6 entries can be made in the 24-hour program.
For an entry, following must be entered:

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

The next day always adopts the operating mode of the previous day until a specific entry is made.
Diagram: The operating mode of the previous day is shown as a broken line.



If no entry is made for a specific day, the operating mode of the previous day is adopted for the whole day and shown as a broken line.
The special day starts and ends with the same operating mode.
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 have been made for a day, that 24-hour program can be copied to the other days. This means that if, for example, Monday has been programmed, that program can be copied to all the other working days (Monday through Friday) and need not be entered again. The program can be copied to Monday through Friday, Monday through Sunday, or to individual weekdays.

5.1.3 Fault handling

For each "Geographical zone", only one time switch master may be used. If several controllers are parameterized as the master, a fault status message is delivered. The message is sent by the controller which receives 2 time switch signals.

Fault status messages

Number	*Text*	*Effect*
5102	>1 time switch in plant 1	Nonurgent message; must be acknowledged

For each “Geographical zone”, only 1 time switch master can be used. If several controllers are parameterized as masters, a fault status message is delivered. The fault is identified by the time switch master (A) if it receives a time switch signal from some other master (B) in its own zone. Then, time switch A displays and delivers a fault status message, but no more time switch signal, to prevent the slaves from switching back and forth.

Number	*Text*	*Effect*
5101	Syst time switch failure plant 1	Nonurgent message; must not be acknowledged

If the controller anticipates a time switch signal via bus, but the signal is not sent, the controller operates in ”Comfort“ mode and fault status message System time switch failure 1 is delivered.

5.2 Holidays / special days

Days 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 the Operating Instructions (B3133x…).
For each RMK770 controller, a holidays / special day program is available. The operating mode to be used during the holiday period can be individually selected for each heating circuit.

Note on holidays / special days

The “Holidays/special day” function is active only if the room operating mode or the DHW Auto mode has been selected for the heating circuit(s) and/or DHW heating.

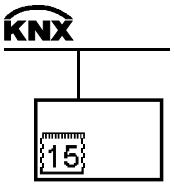
Note on DHW heating

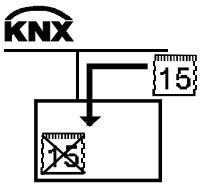
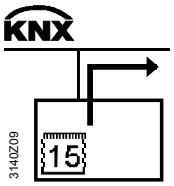
The RMK770 does not provide DHW heating, but DHW signals from the KNX bus can have an impact.

5.2.1 Communication

If the controller is connected to other controllers via bus, the holidays / 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 locally on this controller. The holidays / special day program has no impact on the holidays / special day zone entered under communication.	

Entry	*Effect*	*Diagram*
Slave	The holidays / special day program in this controller is not active. The program acting is the external holidays / special day program that has the same holidays / special day zone set. The external holiday / special day program must be set as the master holidays / special day program	
Master	The holidays / special day program in this controller is active. The holidays / special day program also acts on all other controllers where the holidays / special day program is switched off (slave) and which lie in the same holidays / special day zone.	

Main menu > Commissioning > Communication > Room heating circuit

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

For more detailed information about the setting regarding the communication of holidays / special days, refer to chapter 14 “Communication”.

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 individually selected for each heating circuit and each DHW heating facility. For the heating circuits, the following operating modes can be selected:

Setting

Main menu > Heating circuit > Room operating mode

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

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. These 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 of the controllers (slaves). The time of the special day is a preselection made 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 starting time
- Date and end time
- Reason for entry (holidays or special days)

Setting

Main menu > Heating circuit > Holidays/special days > Calendar

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 (*) for the annual setting.

Priority

If 2 entries overlap, following applies: Special days have priority over holidays. Hence, it is also possible to have a special day during a holiday period.

Example

An example of a special day during the holiday period would be a theatre performance in a school building.

Note

At the end of the holiday period or special day, operation according to the normal 7-day program is 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, thereby 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 purpose, digital inputs must be assigned.

Setting

Main menu > Commissioning > Extra configuration > Heating circuits > Inputs

Operating line	*Range*	*Factory setting*
Holiday input	RMK770…, RMZ7…*	---
Special day input	RMK770…, RMZ7…*	---

* Here, the free inputs are available for selection

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

Special day

The digital input enables the plant to constantly use the special day program set in the 7-day program without necessitating interventions on the controller.
When the configured input is activated, the special day program becomes active. This program is maintained until the input becomes inactive. Then, the normal 7-day program is resumed.

Holidays

The digital input enables the plant to be constantly switched to ”Holidays” mode without necessitating interventions on the controller.
When the configured input is activated, the plant switches to the “Holidays” mode. This program is maintained until the input becomes inactive. Then, the normal 7-day program is 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 priorities 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 configured as slaves in the same holidays / special day zone, the digital inputs act on all these controllers also.

5.2.6 Fault handling

Per holidays / special day zone, only 1 master can be set. If there is more than 1 master in a zone, fault status message ”>1 hol/spec day program” is delivered.
The fault is identified by the holidays / special day master (A) if it receives a holidays / special day signal from some other master (B) in its own zone. Then, master A displays and delivers a fault status message, but no more holidays / special day messages, to prevent the slaves from switching back and forth.
If the controller expects a holidays / special day signal from the bus and the signal is not sent, fault status message ">1 hol/spec day program" is 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/spec day program failure	Nonurgent message; must not be acknowledged
5202	>1 hol/spec day program	Nonurgent message; must be acknowledged

For evaluation of the priority in the holidays / special day program, only the first 2 entries are considered. If more than 2 overlapping entries are made, it may be that the special day no longer has priority over the holidays.

5.3 Frost protection for the plant

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 piping against freezing, frost protection for the plant can activate the relevant pump depending on the **current** outside temperature.
This takes place independent of whether or not there is a heat request. Prerequisite is, however, that frost protection for the plant is activated for the relevant pump:

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Limitations
Main menu > Settings > Boiler ... > Limitations
Main menu > Settings > Primary controller > Limitations

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

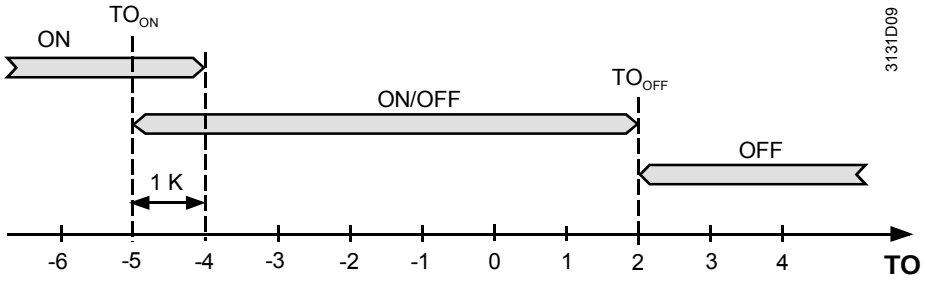
Main menu > Settings > Heating circuit > Limitations

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

The necessity to activate frost protection for the plant is primarily dependent on the hydraulic circuit and the location of the heating pipes in the building. If the heating pipes are not exposed to risk of frost, frost protection for the plant will not be necessary.

Sequence of functions

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



Outside temperature	*Pump*	*Diagram*
<–5 °C (TO_{ON})	Permanently on	ON
–4…+2 °C	On for 10 minutes every 6 hours	ON/OFF
>2 °C (TO_{OFF})	Permanently off	OFF

Adjustable are the following temperatures:

- TO_{ON}: Outside temperature below which frost protection for the plant switches the pump permanently on (frost protection for the plant permanently on)
- TO_{OFF}: Outside temperature below which frost protection for the plant switches the pump periodically on (frost protection for the plant on cycling).

Faulty outside sensor

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

5.4 Pump overrun and mixing valve overrun

For all pumps and all mixing valves, overtemperature protection can be activated. It always becomes active after the burner has shut down. To ensure that the heat consumers still draw heat during a minimum period of time, an overrun time is enforced on the heat consumers that were not switched off more than 1 minute ago. During the overrun time, the pumps and mixing valves continue to operate; the pumps continue to run and the mixing valves maintain the former setpoint.
The duration of the overrun time is dependent upon the type of heat source and can therefore be set separately for every boiler.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Limitations

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

Every consumer has a minimum overrun time of 60 seconds.

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

Pump kick and valve kick are protective functions that are carried out periodically. They prevent pumps and/or valves from seizing after longer off periods (e.g. in the summer). For the kick function to be carried out, the pump or actuator must not have been activated for at least 1 week.

To prevent the pumps and valves from seizing, a point in time (kick day and kick time) can be defined at which the pumps are put into operation and the valves are driven to their fully open and fully closed positions.
The function can be deactivated (pump / valve kick = ---).
It can also be selected whether the function shall apply to pumps only, to valves only, or to both.
The selected setting then applies to all pumps and valves connected to the RMK770 controller. If a plant uses several RMK770, that setting must be made on every controller.

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”).
The running time for the pumps and actuators need not be set. It is always 30 seconds.
If several pumps are used, they are 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 shutoff valves.

5.6 Heat demand and load control

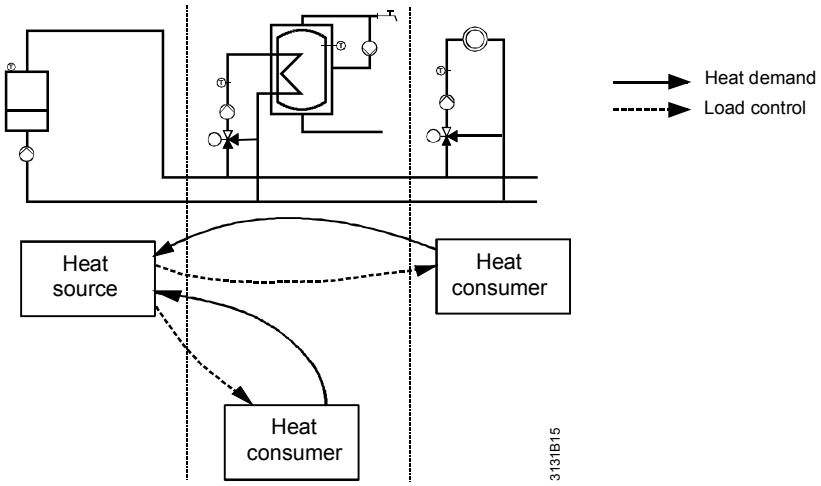
5.6.1 Heat demand

Heat consumers like heating circuits and DHW heating send their heat demand signals to the heat distribution zone “Heat generation”.
An RMU… universal controller or RXB… individual room controller can also send heat demand signals. A demand transformer converts these signals to appropriate heat demand signals (for more detailed information, refer to chapter 8 “Heat demand and heat requests“).
Heat sources or primary controllers receive the heat demand signals and evaluate them. Usually, evaluation consists of a maximum value generation of the temperatures from the heat demand signal.

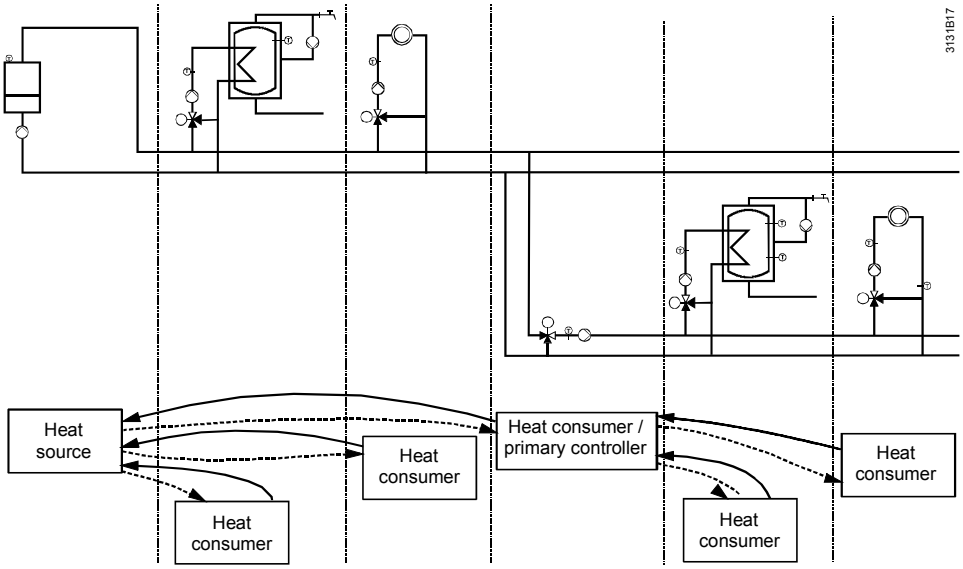
Examples

A heat source or boiler sequence (example 1) attempts to deliver the required amount of heat. A primary controller (example 2) also tries to deliver that amount of heat; in addition, it 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, for example, DHW heating is operated with absolute priority, its heat demand signal must be given priority. This temperature request is therefore the decisive variable.
With 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 the following:

- Protective boiler startup (the 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 and uncritical locking signals
- Shifting DHW priority (if the boiler temperature setpoint is not reached during DHW heating, the amount of heat drawn by the heating circuits is restricted):
  - Load reduction via uncritical locking signals
- Absolute DHW priority (DHW heating is given priority over the heating circuits; the heating circuits may not draw any heat:
  - Load reduction via uncritical locking signals

In many cases, the kind of locking signals to be generated can be parameterized.

Examples of load increases

Examples where an increase in load is demanded are the following:

- Overtemperature protection (pump overrun, mixing valve overrun)
- Use of residual heat in the case of solid fuel boilers (not with the RMK770!)
- Load management in district heat networks (not with the RMK770!)

In the case of 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 require

no more heat. Overrun is typically triggered by a boiler after the burner has 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.

Settings heating circuit

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

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

Settings primary controller

Main menu > Commissioning > Settings > ... or
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

With the primary controller, setting “Response uncritical locking signals” is not used. It never responds to uncritical locking signals because the associated hydraulic actuating devices shall be able to respond depending on the situation.
The locking signal gain is adjustable between 0 and 200%.

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

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

Setting note

If the heat consumer responds too strongly, the value must be decreased; if its response is too weak, 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 is 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.

5.7 Mixing valve control

5.7.1 Control

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Return control
Main menu > Settings > Boiler ... > Return control
Main menu > Settings > Primary controller > Mixing circuit controller
Main menu > Settings > Heating circuit > 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

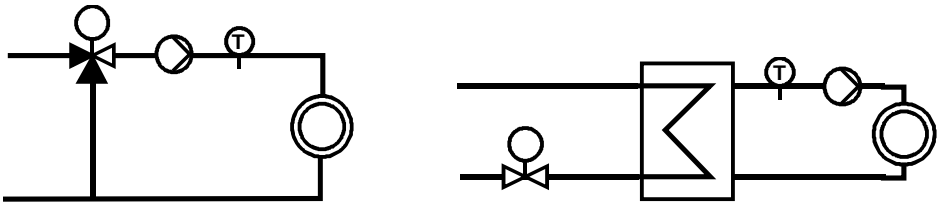
To enable a mixing circuit to control its flow temperature to the setpoint, it requires a higher flow temperature on the inlet side. This elevated temperature can be adjusted separately for each mixing circuit.
In the case of maintained boiler return temperature with mixing valve, this elevated temperature is not needed. Here, it must be made certain that the minimum boiler temperature is somewhat higher than the return temperature setpoint.

For all types of control by the mixing valve (maintained boiler temperature control, primary controller, heating circuit), the same PI mixing valve algorithm is available.

5.7.2 Setting aids

Setting choices

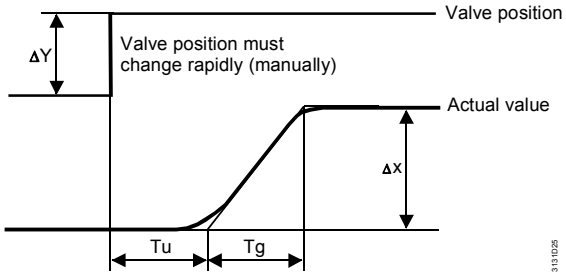
With the help of the P-band (Xp) and the integral action time (Tn), the mixing valve algorithm can be ideally adapted to the relevant controlled system.
The controller is supplied with the control parameters set to values suited for the majority of controlled systems (typically flow temperature control 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 controlled system.



Setting with the help of the step response

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

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 increases 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

Setting rules

P-band Xp = 2 × Tu / Tg × ∆x / ∆y × 100% ˜ 2 × Tu / Tg × Ksmax
Integral action time Tn = 3 × Tu

Example

Change of valve position ∆y = 40%
Change of flow temperature ∆x = 18 K
Tu = 6 s
Tg = 18 s

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

Maximum system gain Ksmax

The maximum system gain Ksmax can be estimated from 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.

Note

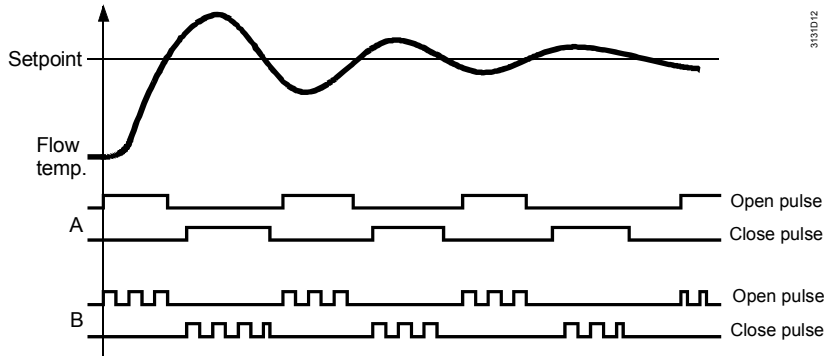
To obtain a reliable step response, it is important during the measurement to keep the temperature upstream of the valve and the return temperature (mixing) as constant as possible.

During the measurement, the boiler and return temperatures should reflect winter conditions at relatively low outside temperatures.

Setting without step response

On actual plant, it is not always possible to get a reliable step response.
Without a 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 for setting the parameters.
A distinction is to be made between 2 cases:

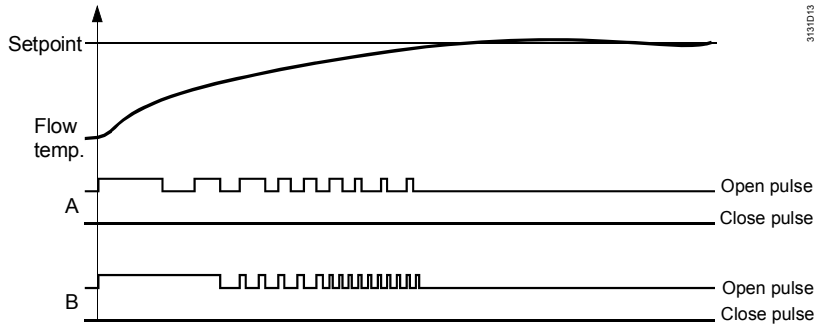
The flow temperature fluctuates about the setpoint



A The control pulses are too long:
Measure the effective valve running time (0…100% stroke) and enter. 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 behavior does not considerably improve: Increase 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 “Control signal”).

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 is readjusted by 100%.

Example

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

Basic rule

Increasing the P-band Xp means: The control responds more slowly and the tendency to oscillate is smaller.

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 given in seconds.
It indicates how long it takes the controller in the event of a constant temperature deviation to cover 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 responds more slowly.

5.7.3 Control signal

Electrothermal actuators

Since the control algorithm uses a stroke model that does not provide control at 0% and 100% respectively, the use of electrothermal actuators is not permitted.

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 1 minute at 10-minute intervals.
If a position change is called for, the synchronization pulse immediately stops.

5.8 Pump control

5.8.1 Hours run counter

The number of operating hours of every pump are counted. The counter’s maximum reading is 99,999 hours. Then, it starts again at 0 hours. In the case of twin pumps, the number of operating hours of pumps A and B are acquired and displayed separately.
The number of operating hours appear at menu item Inputs/setpoints. On the user level, they can only be viewed, on the service level, they can also be readjusted. It is thus possible to set the effective number of hours.

Display values

Main menu > .... > Inputs/setpoints >

Operating line	*Remarks*
Optg hours pump	0…99'999 h
Optg hours pump B	0…99'999 h

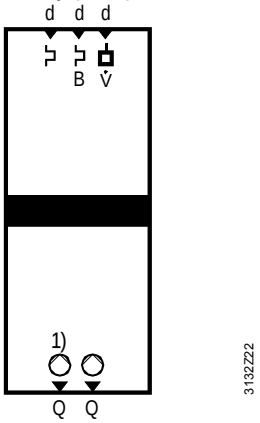
Setting values

Main menu > .... > Inputs/setpoints >

Operating line	*Range*	*Factory setting*
Optg hours pump	0…99'999 h	0 h
Optg hours pump B	0…99'999 h	0 h

5.8.2 Pump supervision and twin pumps

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



The decision whether a pump is installed as a single or twin pump is made in the extra configuration **with the relevant function block** (boiler sequence, boiler, primary controller, heating circuit).

Setting

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Outputs
Main menu > Commissioning > Extra configuration > Boiler ... > Outputs
Main menu > Commissioning > Extra configuration > Primary controller > Outputs
Main menu > Commissioning > Extra configuration > Heating circuit > Outputs

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

When, in addition to the pump, pump B is configured, a single pump becomes a twin pump.
For this second pump, there is also a fault input available. The flow switch is used by both pumps.

Setting

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs
Main menu > Commissioning > Extra configuration > Boiler ... > Inputs
Main menu > Commissioning > Extra configuration > Primary controller > Inputs
Main menu > Commissioning > Extra configuration > Heating circuit > Inputs

Operating line	*Adjustable values / 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 shows menu item Twin pump.

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Twin pump
Main menu > Settings > Boiler ... > Twin pump
Main menu > Settings > Primary controller > Twin pump
Main menu > Settings > Heating circuit > 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

5.8.3 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 takes place.
  When switching on the next time, the pump that starts to run is always the pump that was in operation last
- Pump A is always the working pump; in the event of fault, changeover to pump B takes place. After rectification of the fault, changeover back to pump A takes place
- Pump B is always the working pump.
  In the event of fault, changeover to pump A takes place. After rectification of the fault, changeover back to pump B takes place

Changeover time

The changeover time is the same time as that used for the pump / mixing valve kick (kick day and kick time).
For this reason, this setting must be checked.
Automatic changeover takes place on completion of 168 hours (7 days) or – after a new plant start – when the kick day and kick time are reached.
Even if the pump kick is deactivated, both kick time and kick day remain defined.

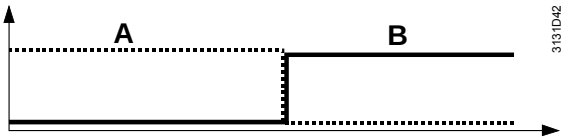
Changeover period

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

- With no interruption
- With overlapping
- With interruption

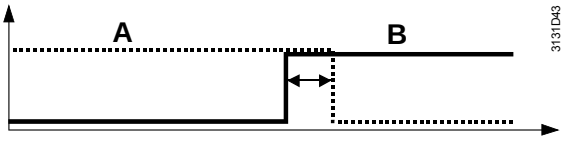
No changeover delay

The changeover from pump A to pump B takes place at the same time:



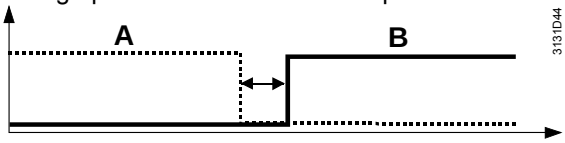
Changeover with negative delay

The changeover from pump A to pump B overlaps, 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 changeover from pump A to pump B is made after a certain pause, e.g. to prevent voltage peaks or excessive water pressures.



Pump kick

The pump kick acts as follows, depending on the priority of changeover:

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
1 of the 2 pumps runs	Not applicable	Kick only acts on the reserve pump

Delayed changeover also acts with the pump kick.

5.8.4 Overload message and supervision of flow

With the pump fault inputs and flow input – as with every digital input – the normal position can be parameterized (... > Settings > Inputs > Terminal ... > Normal position).
If a twin pump is used and one of the pumps becomes faulty, changeover to the other pump takes place.
In any case, a fault status message is delivered.
For acknowledgements, following applies:

- A fault due to a missing fault status message must be acknowledged and reset
- With faults resulting from overload, the acknowledgement and reset behavior can be parameterized

If a pump becomes faulty, the relevant function block is stopped.

With twin pumps, the fault behavior of the respective function block is activated only if **both** pumps fail.

Flow supervision only becomes active 60 seconds after the pump is switched on.

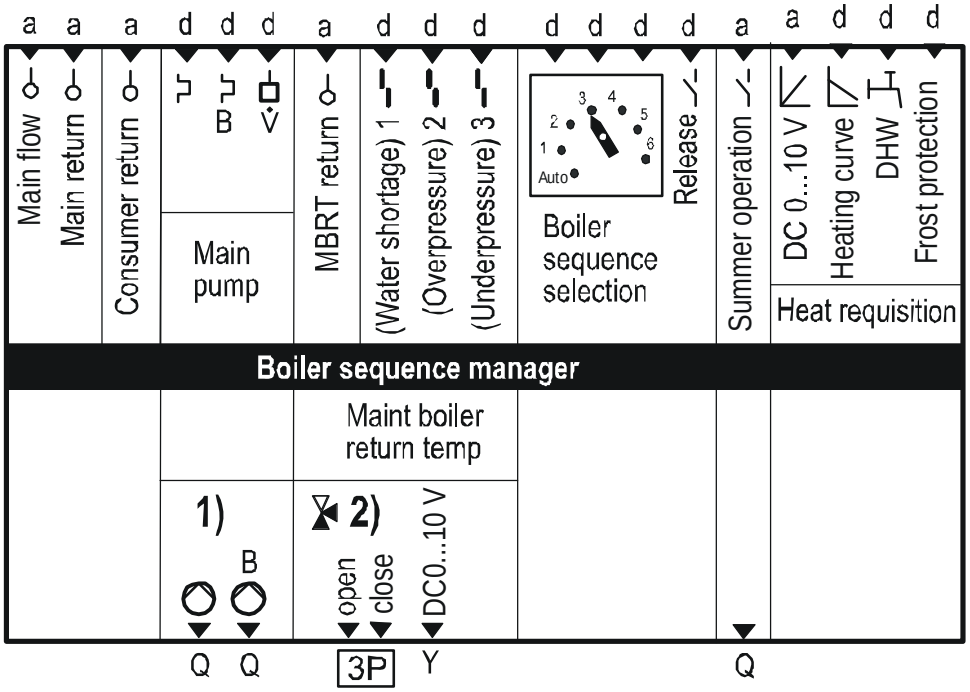
Fault status messages, using the example of the boiler twin pump

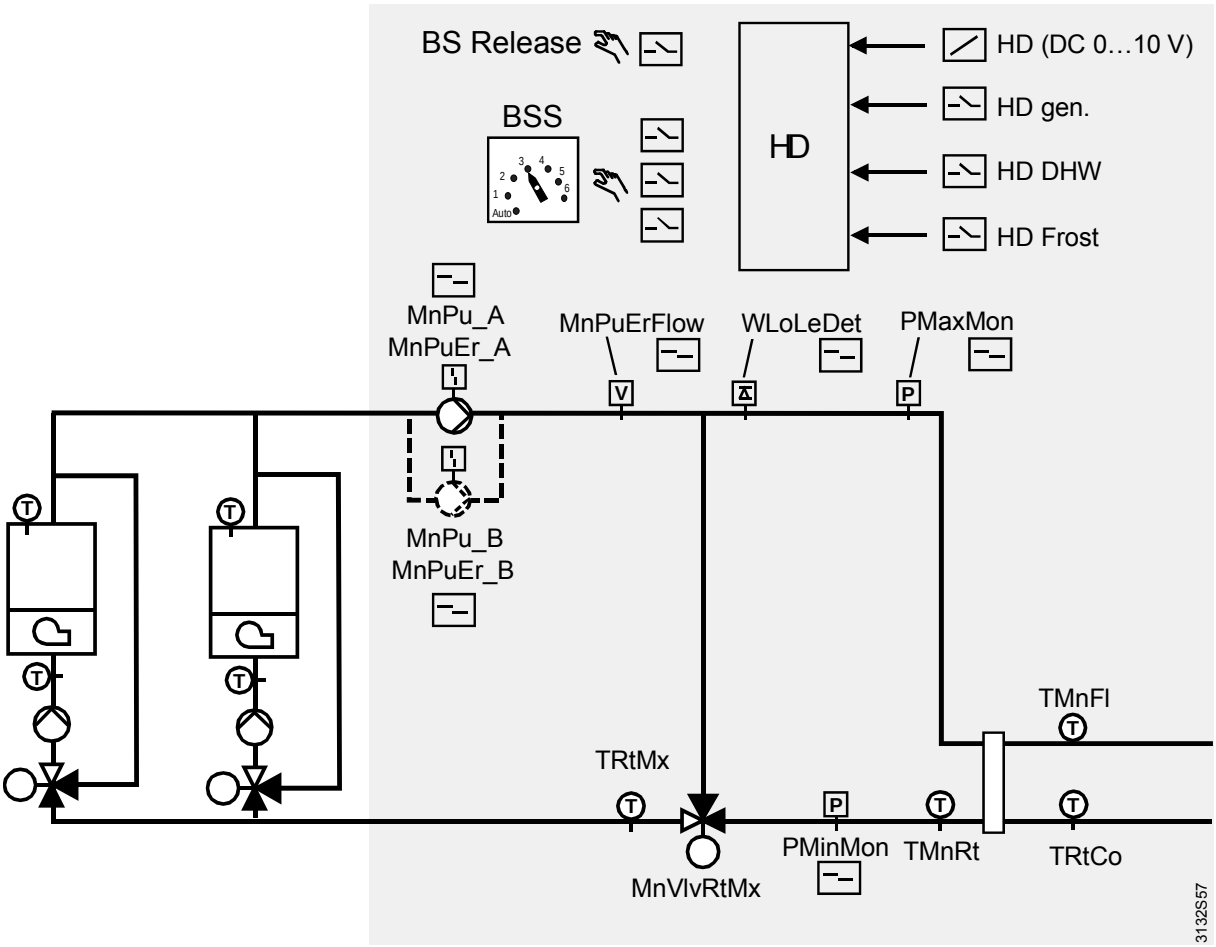
Number	*Text*	*Description*
2401	[K1 pump] overload	Boiler pump, boiler 1, fault overload
2421	[K1 pump B] overload	Boiler pump B, boiler 1, fault overload
2411	[K1 pump] no flow	Boiler pump, boiler 1, flow fault
2431	[K1 pump B] no flow	Boiler pump B, boiler 1, flow fault
2441	[Boiler 1 pump] fault	Boiler pump, boiler 1, fault

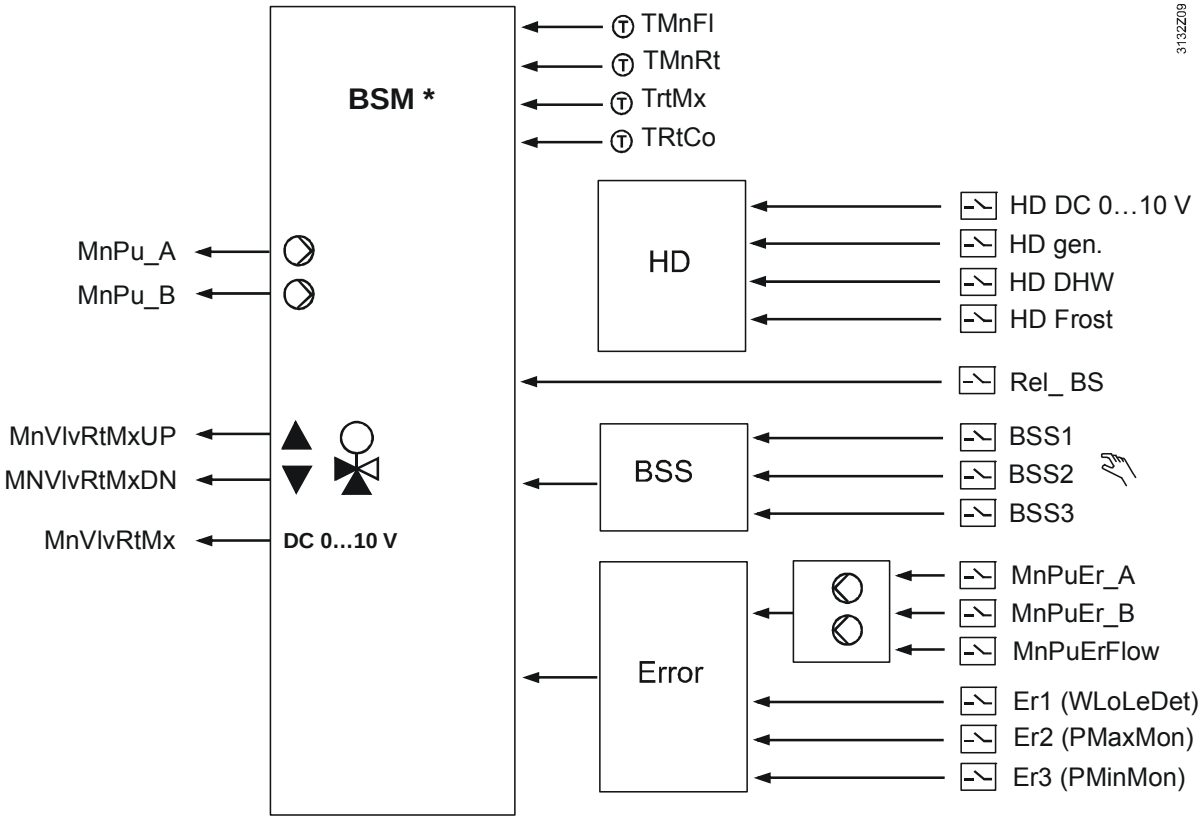
For the complete list of fault status messages, refer to chapter 15 “Fault tracing support”.

6 Boiler sequence management

6.1 Overview of function block







BSM * = boiler sequence manager

Inputs:

TMnFl	Main flow sensor
TMnRt	Main return sensor
TRtCo	Consumer return sensor
MnPuEr_A	[Main pump] overload A
MnPuEr_B	[Main pump B] overload
MnPuErFlow	Main pump flow signal
TRtMx	MBRT return sensor
Er1 (WLoLeDet)	Fault input 1 (water shortage switch)
Er2 (PMaxMon)	Fault input 2 (maximum pressure sensor)
Er3 (PMinMon)	Fault input 3 (minimum pressure sensor)
BSS1	Boiler sequence selection input 1
BSS2	Boiler sequence selection input 2
BSS3	Boiler sequence selection input 3
Release BS	Release input
Summer	Summer operation input
HD DC 0…10 V	Heat request modulating
HD gen.	Heating curve request 2-position
HD DHW	DHW request 2-position
HD Frost	Frost protection request 2-position

Outputs:

MnPu_A	Main pump A
MnPu_B	Main pump B
MnVlvRtMx	MBRT 3-position / MBRT modulating
Summer	Summer operation relay

6.2 Configuration

Basic configuration

Function block “Boiler sequence manager“ is activated by selecting a plant type in the basic configuration. If several RMK770 controllers are used, the boiler sequence manager function is always provided by the RMK770 that can acquire the main flow temperature.

A plant type always requires the configuration of a main flow temperature sensor and a main return temperature sensor. If more than 1 RMK770 is used for a boiler sequence, these sensors may only be configured with the active “Boiler sequence manager” function block.

For each boiler sequence, use of a main flow temperature sensor is highly recommended.

If there is no main flow temperature sensor, the following configuration adopts the measured value inside the controller from the boiler sensor of the current lead boiler:

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs > Main flow sensor: autonomous

This variant can only be used with dual-boiler plant.

The main return temperature sensor is highly recommended in connection with a pressureless header; but its configuration can also be deleted.

Extra configuration

In the extra configuration, the basic configuration can be complemented and/or amended.

Inputs

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs

Operating line	*Adjustable values / remarks*
Main flow sensor	Terminal marking / autonomous
Main return sensor	
Consumer return sensor	Return sensor on the consumer side
[Main pump] overload	Digital input for fault supervision of main pump
[Main pump B] overload	Digital input for fault supervision of main pump B (with twin pumps)
Flow signal	Digital input for flow supervision of main pump
MBRT return sensor	Sensor for maintained main return temperature
Fault input 1	Digital input for fault supervision of boiler sequence
Fault input 2	Digital input for fault supervision
Fault input 3	Digital input for fault supervision
Boil sequence selection input 1	Control input 1 for boiler sequence selection
Boil sequence selection input 2	Control input 1 for boiler sequence selection
Boil sequence selection input 3	Control input 1 for boiler sequence selection
Release input	Release input for the boiler sequence
Summer operation input	Digital input for summer operation
Heat request modulating	
Heating curve request 2-pos	
DHW request 2-pos	DHW request 2-pos
Frost prot request 2-pos	

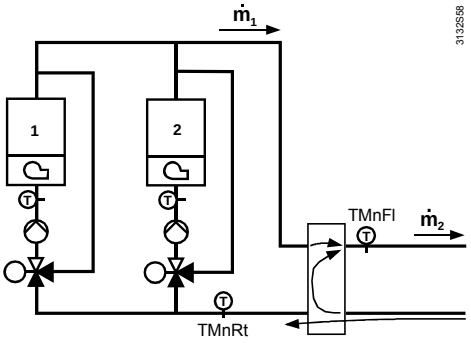
Outputs

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Outputs

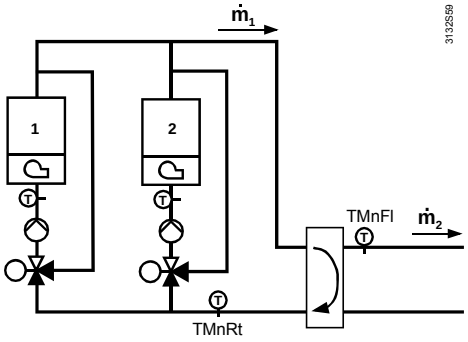
Operating line	*Adjustable values / remarks*
Main pump	
Main pump B	
Maint boiler return temp 3-pos	
Maint boiler return temp mod	
Summer operation relay	

In the extra configuration, additional functions can be activated for the basic functionality of the selected plant type (for more detailed information, refer to the following section).

Main flow and main return temperature sensor



Startup and part load operation ($m_1 < m_2$)



Setback operation ($m_2 = 0$)

Usually, the main flow temperature TMnFl is a mixture of heating circuit return temperature and boiler temperature. The level of mixing depends on the water volumes on the boiler and consumer side.
If no more water can circulate on the consumer side, it can well be that the temperature acquired by the return temperature sensor TMnRt is higher than the main flow temperature TMnFl since there is no circulation at that sensor. To ensure that in such cases there is no demand for unnecessarily high boiler temperatures, it is practical to use the main return temperature as an additional controlled variable. The controller makes automatically a maximum selection of the 2 sensors.

Main pump

With plant types K1.x, K2.x and K3.x, a main pump is preconfigured since these plant types do not have their own boiler pump. Basically, a main pump can be configured for each plant type (... > Outputs... > Main pump). If, in addition, main pump B is configured, the main pump is automatically set as a twin pump.
The main pump always operates when there is demand for heat.
If sustained mode is required for the boiler sequence, ... > Settings > Boiler sequence manager > Sustained mode can be used to parameterize whether the main pump shall also operate in sustained mode.

Common maintained boiler return temperature

For types of plant without individual maintained boiler return temperature, a common maintained boiler return temperature can be delivered. This is activated by assigning a terminal (... > Outputs > Maint boiler return temp 3-pos or Maint boiler return temp mod). In addition, a return sensor for the maintained boiler return temperature must be configured (...> Inputs > MBRT return sensor).

Return sensor on the consumer side

If a frost protection function is required due to the return on the consumer side, a separate return sensor must be configured on the consumer side (... > Inputs... Consumer return sensor).

Fault supervision

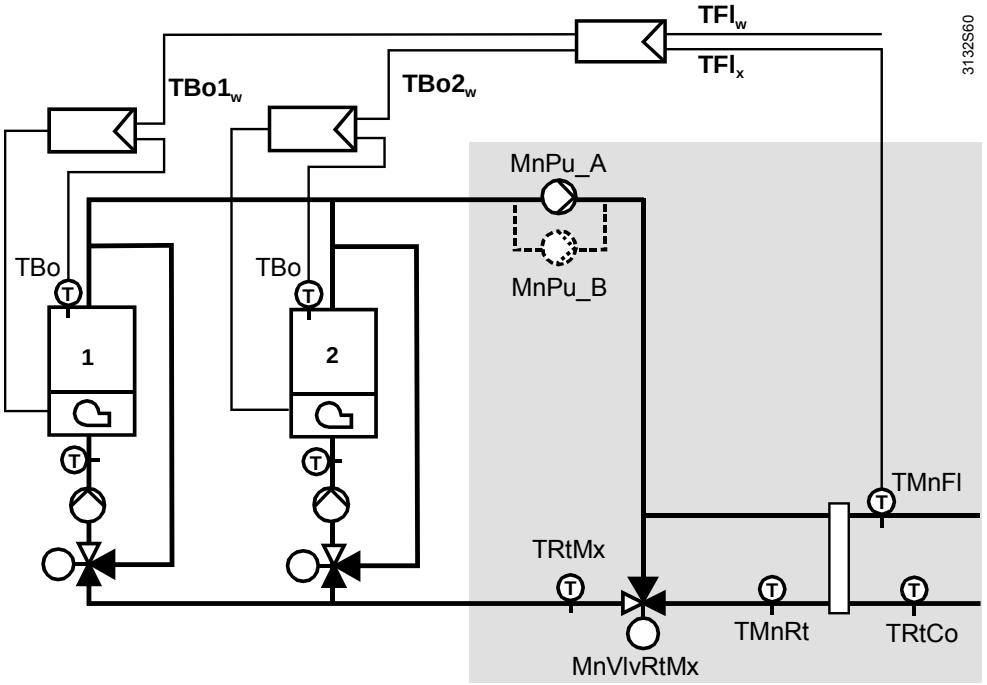
In addition to fault supervision of the main pump and supervision of the main flow temperature sensor, 3 binary fault inputs are provided for fault supervision of the boiler sequence. These are freely configurable.

Heat request

Heat requests from other devices can be accepted via bus. In addition, 3 binary inputs and 1 analog input are available for indicating heat requests.

6.3 Boiler sequence management

6.3.1 Concept



With the signal received from the main flow temperature sensor, the boiler sequence manager controls the individual boilers or burner stages of the boiler sequence. It decides on the release of a boiler, predefines the boiler temperature setpoint for the boilers released and, in addition, releases the individual burner stages depending on heat demand.
Here, the boiler sequence manager differentiates between lead boiler and lag boilers. The lead boiler is always the first boiler to be put into operation. It always maintains the boiler temperature setpoint predefined by the boiler sequence manager. The boiler temperature setpoint of the lead boiler is raised or lowered, depending on the deviation of the temperature acquired by the main flow sensor from the setpoint. The setpoint correction can be adjusted.

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Boiler setpoint boost max	0…100 K	10 K

An increase can be applied to the boiler temperature setpoint of the lag boilers.

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Operation settings

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

A considerable increase of the boiler temperature setpoint ensures that the lead boiler provides control and that the relevant lag boiler operates at full capacity. This approach prevents several boilers with their burner stages from cycling simultaneously.

When using a small increase or no increase at all, the relevant lag boiler also operates in control mode. This can be desirable in the case of boiler sequences with several modulating burners.
Control of the burner, boiler pump and actuating devices is ensured by the individual “Boiler“ function blocks.
The boiler sequence manager releases the boilers in a stepwise fashion; first the basic stage and then the second stage or modulation.

6.3.2 Orders for boilers to be switched on and off

As a general rule, the boilers are switched on in ascending order and switched off in descending order:
1 – 2 – 3 – 4 – 5 – 6
However, various functions, settings and signals at the control inputs can impact this order.

Boiler sequence selector

The boiler sequence selector is used to define the lead boiler and the switch-on sequence according to which the boilers are switched on.

Boiler sequence selection on the operator unit

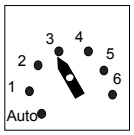
Main menu > Boiler sequence manager > Boiler sequence optg mode

Operating line	*Range*	*Factory setting*
Boiler sequence selection, manually	Auto / 1…6	Auto

Auto	Automatic changeover of lead boiler after an adjustable period of time
1	Boiler sequence **1**–2–3–4–5–6
2	Boiler sequence **2**–3–4–5–6–1
3	Boiler sequence **3**–4–5–6–1–2
4	Boiler sequence **4**–5–6–1–2–3
5	Boiler sequence **5**–6–1–2–3–4
6	Boiler sequence **6**–1–2–3–4–5

External boiler sequence selector

The boiler sequence can also be preselected with an external selector. In that case, the selection on the operator unit is deactivated.



Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs

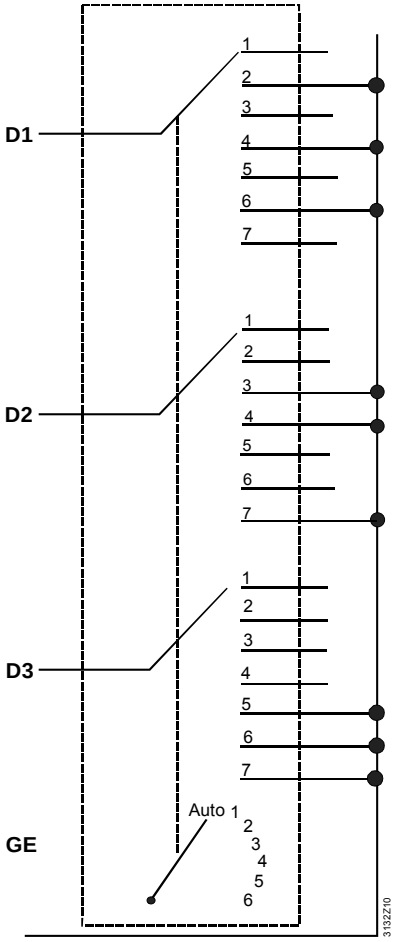
Operating line	*Adjustable values / remarks*
Boil sequence selection input 1	Assign terminal
Boil sequence selection input 2	Assign terminal
Boil sequence selection input 3	Assign terminal

The input's operating mode can be parameterized for each terminal.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs > RMK770... or RMZ78...

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

If the selection shall only be made between Auto and boiler 1, one binary input is sufficient. With 2 binary inputs, the selection can be made between Auto – 1 – 2 – 3, and with 3 binary inputs between Auto – 1 – 2 – 3 – 4 – 5 – 6.
The selector must be appropriately wired.



		D1	*D2*	*D3*
Position 1	Auto	0	0	0
Position 2	Boiler 1	1	0	0
Position 3	Boiler 2	0	1	0
Position 4	Boiler 3	1	1	0
Position 5	Boiler 4	0	0	1
Position 6	Boiler 5	1	0	1
Position 7	Boiler 6	0	1	1

Automatic boiler changeover

In Auto position, the lead boiler and the associated boiler sequence can do an automatic changeover depending on the burner hours run of the lead boiler.

Note

The burner hours run are calculated by the boiler sequence manager and are independent of the hours run counters of the individual boilers.

Automatic boiler changeover ensures that the number of burner operating hours of the individual boilers are pretty much the same.

Setting

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Changeover interval	----, 1…1440 h	500 h
Changeover day	--- / Monday…Sunday	Tuesday
Changeover time	00:00…23:59	04:00

If the period of time for the changeover interval is set to ---, there is no automatic changeover.

To make certain that changeover to another lead boiler does not take place at an awkward point in time (e.g. on a weekend), the time of changeover (weekday, time of day) can be set.
On completion of the period of time set (see settings above), the next boiler is selected as the lead boiler.

Fixed lead boiler

It may be desirable to always use the same boiler as the lead boiler and to only have the other boilers change their sequence (e.g. 1 boiler sequence with 1 modulating burner and several multistage burners).
In that case, one of the boilers can be defined as the fixed lead boiler.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Lead boiler fixed	---- / 1…6	----

Note

The boiler defined in this way only remains the fixed lead boiler when using automatic boiler changeover.

Backup boiler

It is also conceivable to select a boiler as a backup boiler, e.g. an old boiler which no longer meets environmental requirements and which, therefore, may only be used to a limited extent.
If a boiler is defined as a backup boiler, that boiler is always the last to be switched on. Several boilers can be defined as backup boilers. These are then switched on in ascending order.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Operation settings

Operating line	*Range*	*Factory setting*
Backup boiler	Yes / No	No

Note

The “Backup boiler” setting also applies to operating mode “Boiler sequence selection manual”.

Boiler release

A boiler can be released or locked via binary input or in the “Boiler operating mode” setting.

Main menu > Boiler ... > Boiler operating mode

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

In the case of “Off“ via binary input, it is also possible to select whether this “Off” is unconditional or if, in the event of frost, it can be overridden.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Limitations

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

With “Off” via digital input = Off, the boiler is **not** put into operation, even if there is risk of frost. With the “On” setting, the boiler can be put into operation by the boiler sequence manager if there is risk of frost.

Locking of boiler depending on the outside temperature

If required, a boiler can be locked depending on the outside temperature.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Operation settings

Operating line	*Range*	*Factory setting*
Boiler lock outside temp >	---- / 5…30 °C	---- °C
Boiler lock outside temp <	---- / –50…10 °C	---- °C

If the outside temperature exceeds the limit value or drops below it (refer to section 7.5 “Releasing and locking a boiler”), the respective boiler is locked or released again with low priority only (see below under ”Priorities”).

Boiler fault

The boiler sequence manager keeps faulty boilers released. As long as the fault is pending, function block “Boiler“ keeps the boiler switched off. When the fault is rectified, the boiler is put back into operation. The boiler sequence manager then decides if and which boiler will have to be switched off.

As a result of the evaluation of the different settings and functions, the boilers are assigned different priorities for the switch-on sequence.

Priorities

- Priority 1 is always assigned to the fixed lead boiler (with no restriction)
- Priority 2 is assigned to all the other boilers (with no restriction)
- Priority 3 is assigned to the backup boilers
- Priority 4 is assigned to the boilers with locking by the outside temperature
- Priority 5 is assigned to the boilers with (conditional) manual locking (release input)
- Priority 6 is assigned to the boilers with (unconditional) manual locking (release input)

The boiler released first is always the boiler with the highest priority. If several boilers have the same priority, they are released according to their order of changeover. Then, the procedure is repeated with the next higher priority.

Diagnostic choice boiler order

Main menu > Boiler sequence manager > Boiler sequence order

Operating line	*Adjustable values / remarks*
Address number lead boiler	1
Address number 1st lag boiler	2
Address number 2nd lag boiler	3

The Boiler order menu shows the boiler order currently used.

6.3.3 Boiler sequence order

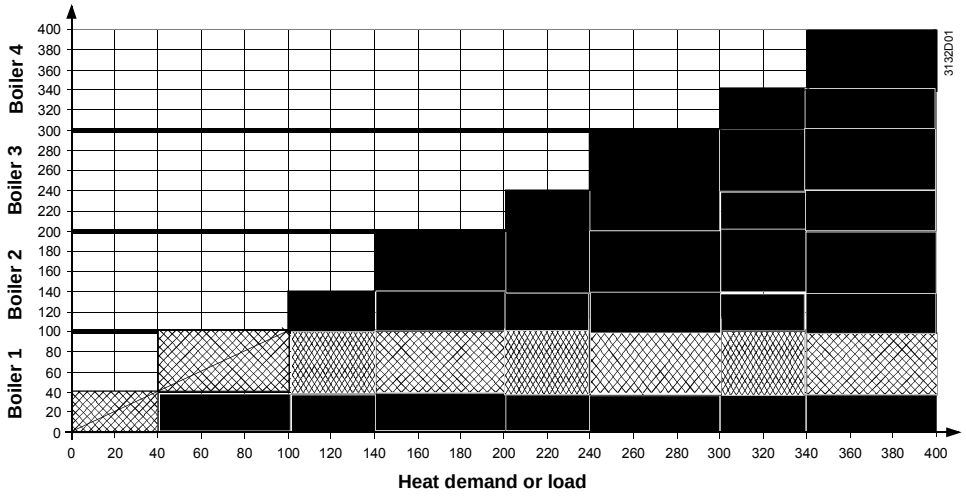
Standard

Normally, as the demand for heat increases, another boiler is switched on, whereby only the first burner stage (x.1) is released first, followed by the second stage (x.2) or modulation. Also refer to subsection 6.3.6 “Switching boilers on and off”.

Output stage	*1*	*2*	*3*	*4*	*5*
Boiler release	1.1	1.1+1.2	1.1+1.2+2.1	1.1+1.2+2.1+2.2	1.1+1.2+2.1+2.2+3.1

Example

Boiler sequence with 4 boilers and 2-stage burners as an example. Lag boilers with great setpoint increase.



Burner stage in continuous operation

Burner stage cycling

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler ... > Operation settings

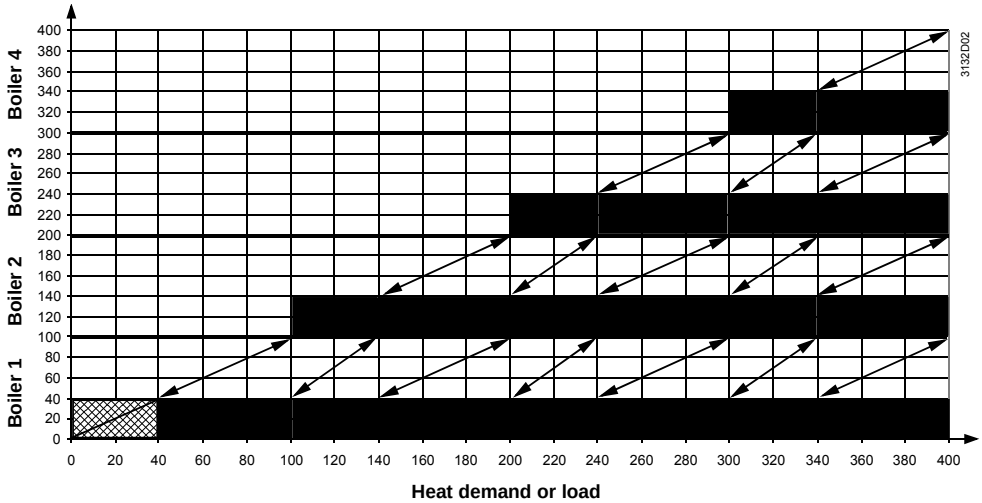
Operating line	*Range*	*Factory setting*
Setpoint increase lag boiler	0…50 K	10 K

A great setpoint increase (to be set separately on each boiler) allows the lead boiler to provide control while the relevant lag boiler operates at full capacity. This way, it is made certain that several boilers with their burner stages do not cycle simultaneously.

With a small setpoint increase, or no increase at all, the relevant lag boiler also provides control. This can be especially desirable in the case of boiler sequences with several modulating burners.

Example

Boiler sequence with 4 boilers and modulating burners as an example.
Lag boilers with small setpoint increase or no increase at all.



Burner stage modulating

Binary switching on

In the case of boilers with greatly different capacities (e.g. second boiler twice the capacity of the first boiler), the second boiler can be put into operation after the first boiler and the first boiler is shut down. The first boiler resumes operation only when both stages of the second boiler are on. This ensures a better graduation of the total boiler output.

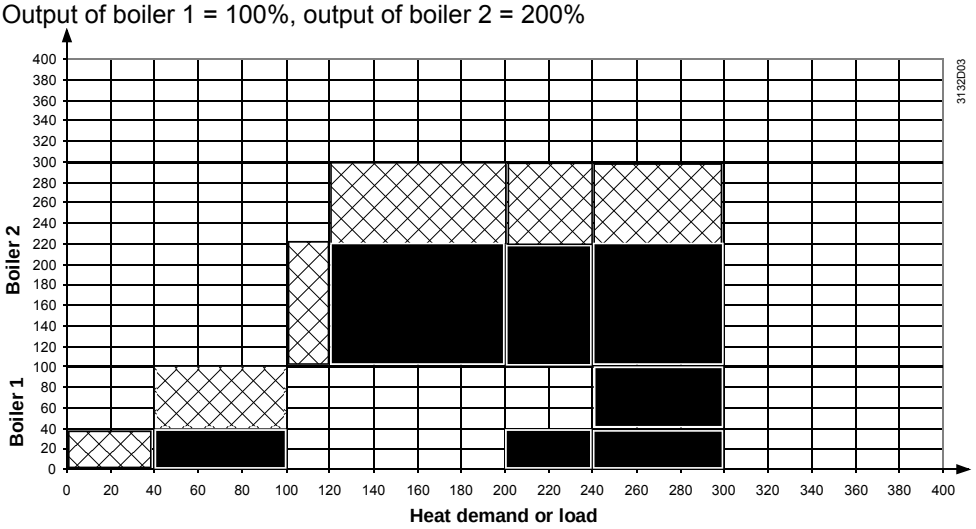
This approach can be chosen only if the output of the basic stage of boiler 2 exceeds the rated capacity of boiler 1. If this strategy is chosen, a fixed boiler sequence makes sense, thereby ensuring that the same boiler is always boiler no. 2.

Output stage	*1*	*2*	*3*	*4*	*5*
Boiler release	1.1	1.1+1.2	2.1	2.1+2.2	1.1+2.1+2.2

This switch-on order is called binary switching on. With the RMK770, binary switching on is restricted to the first 2 boilers. The next boilers are switched sequentially. With binary switching on, boiler 2 is always the controlling boiler.

Example

Binary switching of boiler sequence with 2 boilers:
Output of boiler 1 = 100%, output of boiler 2 = 200%



Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Boiler sequence strategy	Sequentially / Binary-sequentially	Sequentially

6.3.4 Boiler sequence operating mode

or Main menu > Boiler sequence manager > Boiler sequence optg mode

Operating line	*Range*	*Factory setting*
Preselection	Off / Summer operation / Auto	Auto
State	On / Off	
Cause	Commissioning Operating mode selector Frost protection for consumer / Flow/return frost protection / Sustained mode Overtemp protection / Overrun / Protective boiler startup seq Flue gas measuring mode Manual control No boiler sensor available / No request / Request	
Summer operation	Inactive / Active	
Boil sequence selection manual	Auto / 1…6	Auto

or Main menu > Boiler sequence manager > Boiler sequence optg mode

Operating line	*Range*	*Factory setting*
Setp preselection manual	---- / 8…140 °C	---- °C

The available boiler operating modes are “Off“, “Summer operation“ and “Auto“.
In “Off“ mode, the only heat requests considered are emergency requests (e.g. ”Frost prot request 2-position” at the heat request input).

During “Summer operation“, the only heat requests accepted are those from DHW heating (digital input or via KNX bus).
All other heat requests are ignored. Emergency requests are always accepted. The “Summer operation“ state is also distributed via the KNX bus. For example, the RMH760B heating controller can switch DHW heating from the boiler to the electric immersion heater.

In “Auto“ mode, the boiler sequence manager activates the “Summer operation“ state automatically. The change to ”Summer operation“ takes place at midnight if – before – the boiler sequence manager did not receive any heat requests from the heating circuits for 72 hours. A heat request from DHW heating is considered however.

Boiler sequence release input

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs

Operating line	*Adjustable values / remarks*
Release input	(Assign terminal)

With the binary boiler sequence release input, it is possible to change over between the current boiler sequence operating mode and “Off“.
The digital input has priority over boiler sequence operating mode selection on the operator unit and the summer operation input.

The input’s operating action can be parameterized.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs > RMK770... or > RMZ78...

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

“Normal position = Open“ means that when the contact is open, the boiler sequence is not released, or that boiler sequence operating mode “Off” applies to the boiler sequence.

Summer operation input

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs

Operating line	*Adjustable values / remarks*
Summer operation input	(Assign terminal)

Using the binary summer operation input, it is possible to switch between boiler sequence operating mode “Auto” and ”Summer operation“.
The digital input has priority over boiler sequence operating mode selection “Auto“ on the operator unit.

The input’s operating action can be parameterized.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs > RMK770... or > RMZ78...

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

“Normal position = Open“ means that when the contact is open, the boiler sequence operating mode is not determined by the summer operation input.

Summer operation relay

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Outputs

Operating line	*Adjustable values / remarks*
Summer operation relay	(Assign terminal)

With the help of the summer operation relay, the “Summer operation“ state can be signaled to external devices.

Summer operation

On the basis of the plant's layout, the number of boilers required for heat generation in the summer are usually known (e.g. for DHW heating). If the "Summer operation" state is active in the boiler sequence manager, the number of boilers released can be limited.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler sequence manager > Summer operation

Operating line	*Range*	*Factory setting*
Number of boilers released	0…6	6

6.3.5 Sustained mode

When there is no demand for heat, there is no need for the boiler sequence to provide heat. In that case, depending on the types of boiler used in the boiler sequence, all boilers can be switched off or are maintained at a minimum temperature level. With certain types of plant, it is important however to have heat available as quickly as possible. For that purpose, a sustained mode can be defined. If there is no heat request, the temperature of the lead boiler is maintained at the adjusted sustained mode setpoint. In that case, only the first stage of the lead boiler is released.
The minimum temperature of the relevant boiler is maintained depending on the parameter setting made, independent of the sustained mode setpoint.
Also, it can be selected whether or not a main pump – if installed – shall run during sustained mode. If released in sustained mode, the main pump practically always runs.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler sequence manager > Sustained mode

Operating line	*Range*	*Factory setting*
Release main pump	Yes / No	No
Sustained mode setpoint	---- / 8…140 °C	---- °C

The binary control input for the boiler sequence release can interrupt sustained mode.

6.3.6 Switching boilers on and off

Based on the demand for heat and the current main flow temperature, the boiler sequence manager releases 1 or several boilers.

Main menu > Commissioning > Settings > ... or

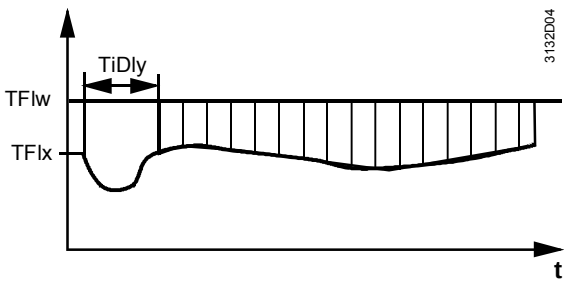
Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Upward sequence integral	0…500 K×min	200 K×min
Downward sequence integral	0…500 K×min	50 K×min
Upward sequence delay	0…255 min	5 min
Shortened upward seq DHW	0…100%	0%

Switching boilers on

Switching on via the temperature-time integral

Additional boilers are released only if, for a certain period of time, the main flow temperature stays below the neutral zone about the setpoint. The criterion used for switching on the second burner stage is a temperature-time integral.



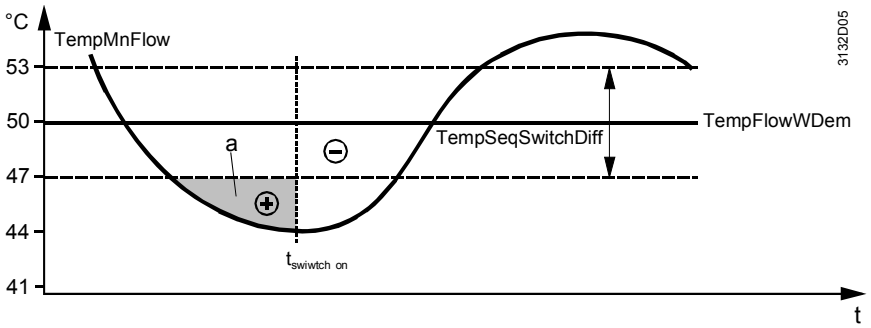
The moment an additional boiler is switched on, the flow temperature can drop for some time if the boiler was started up from “cold“. To prevent this undershoot from instantly switching on another boiler, a waiting time can be set before performance of the integral is started (TiDly, upward sequence delay).

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Upward sequence integral	0…500 K×min	200 K×min
Upward sequence delay	0…255 min	5 min

Setting the upward sequence integral defines the output deficit that shall cause an additional boiler to be switched on.



TempFlowWDem	Flow temperature setpoint for performing the integral
TempSeqSwitchDiff	Neutral zone (3 K)
TempMnFlow	Main flow temperature
t	Time
t switch on	Time to elapse for boiler to be switched on

Accelerated release during DHW charging

During DHW charging, additional boilers can be released more quickly than in normal heating mode.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Shortened upward sequence DHW	0…100%	0%

The percentage of the shorter upward sequence for DHW determines how much earlier the boiler shall be released.
For example, if the value is at 25%, performance of the integral for the second boiler is started after ¾ of the switch-on delay and the switch-on integral need only be 75% of the value set. And for every additional boiler, the accelerated performance of the integral applies. The switch-on delay is at its initial value again.

Switching boilers off

When there is a valid temperature request, it is always the basic stage of at least one boiler that is released. If there is no temperature request, all boilers are immediately locked.
If heat consumption drops, the boilers are switched off based on the temperature criterion or output balance.

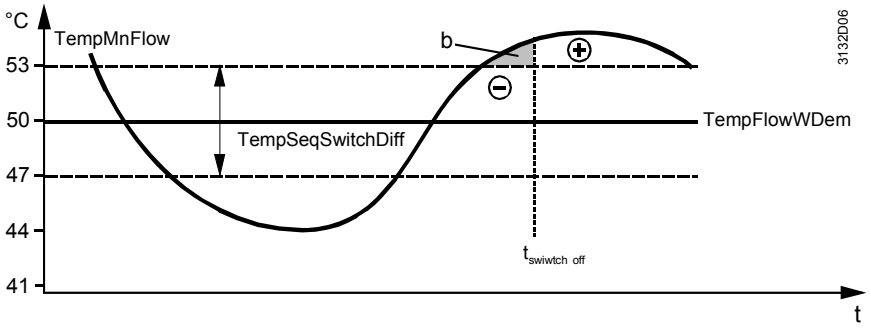
Switching off via the temperature-time integral

In the case of surplus output, the temperature deviation is accumulated, the same way as with output shortage. Boilers are locked only if the main flow temperature lies above the neutral zone about the setpoint.
To ensure that the boilers are switched off in steps, the switch-off integral is restarted each time a boiler is shut down.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Downward sequence integral	0…500 K×min	50 K×min

The switching off of a boiler can be impacted by the switch-off integral.
A small switch-off integral means that removal of a boiler from the boiler sequence is fast.



TempFlowWDem	Flow temperature setpoint for performing the integral
TempSeqSwitchDiff	Neutral zone (3 K)
TempMnFlow	Main flow temperature
t	Time
t switch off	Time to elapse for boiler to be switched on

Switch-off command via output balance

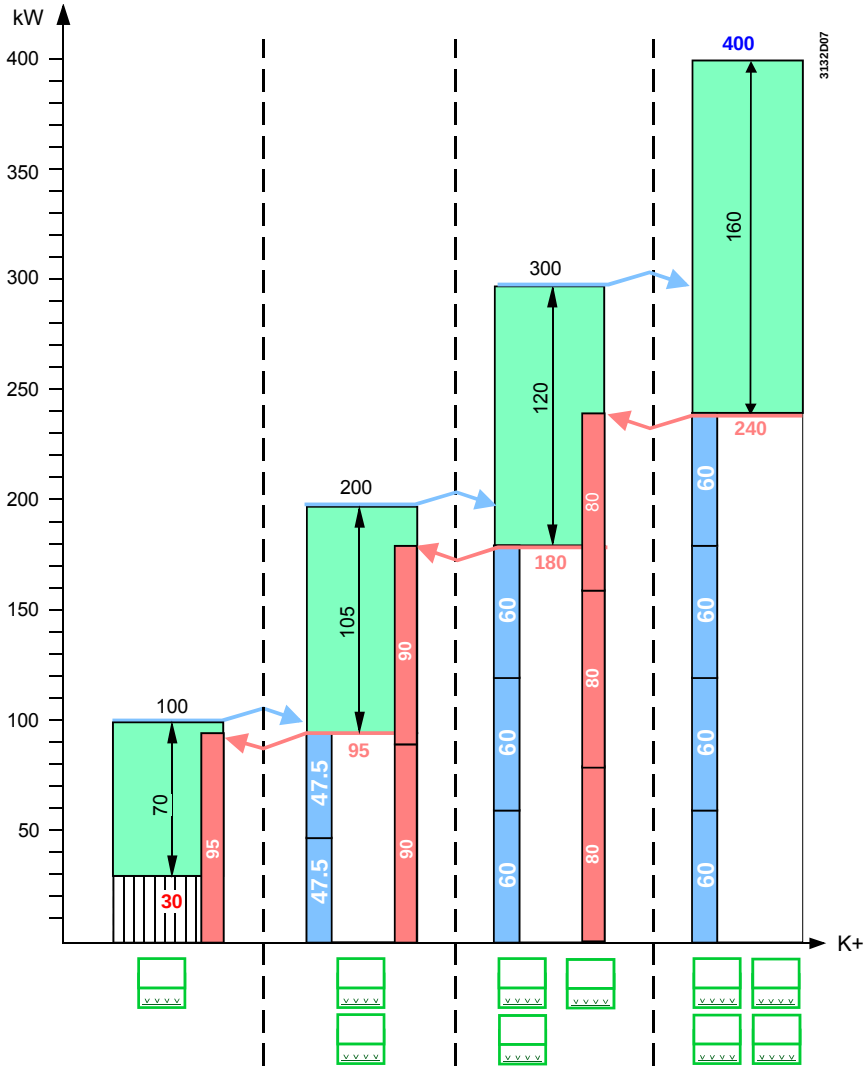
Switching off via the output balance prevents a large number of boilers from operating at low output although heat demand could be covered by a smaller number of boilers.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Control parameters

Operating line	*Range*	*Factory setting*
Downward sequence output limit	0…100%	--- %

If several boilers maintain simultaneously the same setpoint – e.g. in the case of modulating or 2-stage burners where the individual setpoint boost is set to 0 K or to a very small value – the output balance is added as a second switch-off criterion.
For 20 minutes, the average boiler output of the boilers in operation must be smaller than the downward sequence output limit. Also, to ensure that sufficient amounts of heat can be delivered after boilers have been switched off, it is checked whether the calculated required output of the boilers remaining in operation would amount to a maximum of 95%.

Example



The diagram above shows an example with 4 modulating boilers that are sequentially switched on and off.
The basic stage of the first boiler be 30% of the rated capacity.
As heat consumption increases, each boiler modulates up to 100 kW (100%) before the next boiler is switched on. Hence, 4 boilers can modulate delivering a total output of 400 kW.
The downward sequence output limit is set to 60%.

Switching boiler 4 off

To enable the fourth boiler to be switched off, all 4 boilers must have modulated below 240 kW (60% of 400 kW) for 20 minutes, that is, below 60 kW on average. After switching off, the operating point of the remaining 3 boilers is at 80 kW.

Switching boiler 3 off

To enable the third boiler to be switched off, all 3 boilers must have modulated below 180 kW (60% of 300 kW) for the duration of the switch-off delay, that is, below 60 kW on average. After switching off, the operating point of the remaining 2 boilers is at 90 kW.

Switching boiler 2 off

To enable the second boiler to be switched off, both boilers must have modulated below 95 kW for the duration of the switch-off delay, that is, below 47.5 kW on average. If switching off took place at 60 kW as above, the second boiler would switch on again after a short period of time due to insufficient heat supply. Hence, the operating point of the remaining boiler after switching off is at 95 kW.

Note

If the boilers cannot modulate at a sufficiently low level, the main flow temperature rises until a boiler is switched off via the temperature-time integral.

6.4 Supervision of faults

Supervision of main pump

The main pump (main twin pump) can be monitored with an overload input each and/or a flow switch each (... Extra configuration > Boiler sequence manager > Inputs).

The parameters for the pump or twin pump fault inputs are fixed and cannot be changed.

The fault status signal delay for the flow switch is 60 seconds.

The setting parameters for the main twin pump can be found on menu ... Settings > Boiler sequence manager > Twin pump. For more detailed information about the functionality of the twin pump, refer to chapter 5 “General functions, fundamentals”.

Fault status messages

Number	*Text*	*Effect*
2491	[Main pump] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“
2492	[Main pump B] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“
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] fault	Urgent message; , must not be acknowledged, plant stop

For fault supervision of the boiler sequence, there are 3 binary fault inputs available. These are freely configurable, whereby the 3 fault outputs use the following factory settings:

Fault supervision of boiler sequence

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Fault settings > Fault input 1

Operating line	*Range*	*Factory setting*
Fault text	A…Z	Water shortage
Impact of fault	Stop / No stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Nonurgent	Urgent
Fault status signal delay	00.00…59.55 m.s (minutes.seconds)	00.05 m.s

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Fault settings > Fault input 2

Operating line	*Range*	*Factory setting*
Fault text	A…Z	Overpressure
Impact of fault	Stop / No stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Nonurgent	Urgent
Fault status signal delay	00.00…59.55 m.s	00.05 m.s

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Fault settings > Fault input 3

Operating line	*Range*	*Factory setting*
Fault text	A…Z	Underpressure
Impact of fault	Stop / No stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Nonurgent	Urgent
Fault status signal delay	00.00…59.55 m.s	00.05 m.s

The effect of the “Stop“ fault is that the boiler sequence as a whole is shut down. Boilers and pumps are switched off.
The type of fault input can be parameterized at the relevant terminal.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs

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

Fault status messages

Number	*Text*	*Effect*
2391	[Boiler seq] water shortage	Can be parameterized
2392	[Boiler sequence] overpressure	Can be parameterized
2393	[Boiler sequence] underpressure	Can be parameterized

For more detailed information about faults, refer to chapter 13 “Function block “Faults“”.

Supervision of main flow temperature

In addition to the 3 binary fault inputs, the temperature at the main flow sensor can be monitored. If the main flow temperature does not reach the required level within the adjustable fault status signal delay, a fault status message is delivered. It is only monitored whether the required temperature is reached. If the temperature is too high, no fault status message is delivered (reason: in the case of minimum limitation of the boiler temperature or sustained mode, the flow temperature can reach too high a level).
When setting ----, the function is deactivated.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Fault settings > Supervision

Operating line	*Range*	*Factory setting*
Fault status signal delay	---- / 0…100 h	---- h

A short-circuit or open-circuit of the main flow temperature sensor causes a plant stop of the entire boiler sequence.
The main return temperature sensor is less crucial. If faulty, there is no plant stop.

Fault status messages

Number	*Text*	*Effect*
2396	Main flow temp not reached	Nonurgent message, must be acknowledged, no plant stop
330	Main flow sensor error	Urgent message; must be acknowledged and reset, plant stop
331	Main return sensor error	Nonurgent message; must be acknowledged, no plant stop

Sensor supervision in general

The other sensors, which also belong to function block “Boiler sequence manager“, such as the return sensor for the common maintained boiler return temperature, or the return sensor for the consumers, are monitored for short-circuit and open-circuit.

Fault status messages

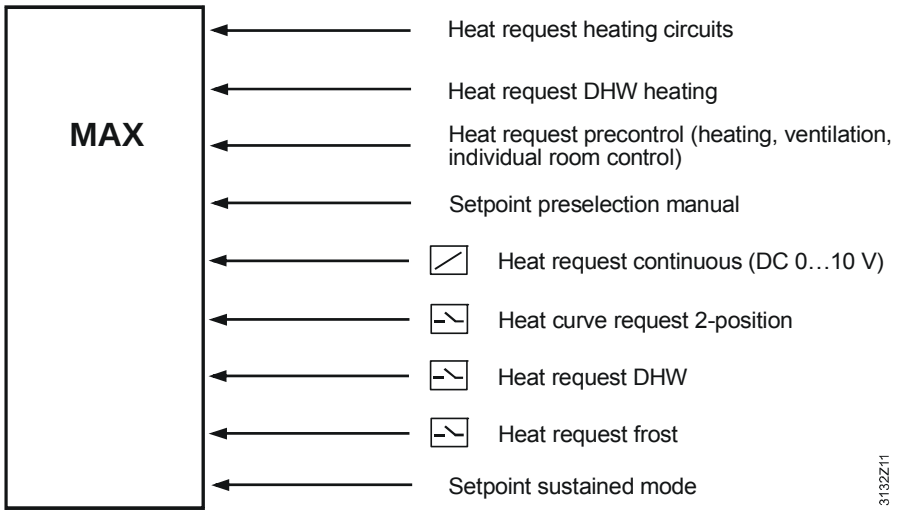
Number	*Text*	*Effect*
332	[Boiler seq] MBRT sensor error	Nonurgent message, must be acknowledged, no plant stop
333	Consumer return sensor error	Nonurgent message, must be acknowledged, no plant stop

More than 1 boiler faulty

Number	*Text*	*Effect*
2300	>1 boiler faulty	Urgent message, must not be acknowledged, no plant stop (the faulty boilers have already been shut down)

The fault with the highest priority is sent via the KNX bus. If more than 1 boiler is faulty (and thus shut down), fault status message ”>1 boiler faulty” is delivered. Without this fault status message, the message of only 1 boiler would appear.

6.5 Heat demand and heat request



Function block “Boiler sequence manager“ collects the heat requests from all consumers (heating circuit, DHW heating and primary controller), the external inputs and the manual setpoint preselection. These setpoints are used to generate the maximum value.

or Main menu > Boiler sequence manager > Boiler sequence optg mode

Operating line	*Range*	*Factory setting*
Setp preselection manual	---- / 8…140 °C	---- °C

If there is no heat request, sustained mode can become active, if parameterized.
On the controller, 1 analog and a maximum of 3 digital inputs can be configured as heat demand inputs.

Main menu > Commissioning > Extra configuration > Boiler sequence manager > Inputs

Operating line	*Adjustable values / remarks*
Heat request modulating	
Heating curve request 2-pos	
DHW request 2-pos	
Frost prot request 2-pos	

The three 2-position heat requests differ in the type of heat request.
Depending on the selection of the boiler sequence operating mode (... > Main menu > Boiler sequence manager > Boiler sequence optg mode > Preselection), either all 3 types are evaluated or only individual ones.

Boiler sequence optg mode	
Off	Only the frost input is considered
Summer operation	Generation of maximum value from the DHW and frost inputs
Auto	Generation of maximum value from all 3 inputs

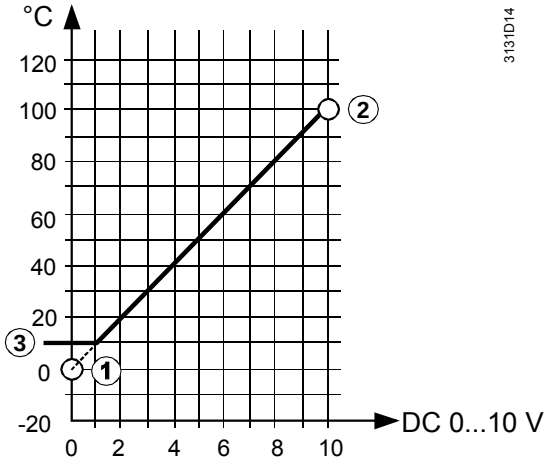
6.5.1 Heat request modulating

Heat demand can be predefined with a DC 0…10 V signal.
The signal can be matched to the DC 0…10 V signal source:

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler sequence manager > 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 below this level are interpreted as “no heat demand”)

6.5.2 Heat request 2-position

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler sequence manager > Heat request

Main menu > Settings > Primary controller > Heat request

Operating line	*Range*	*Factory setting*
[2-pos] setpoint DHW	0…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	0…140 °C	70 °C

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler sequence manager > Demand control

Main menu > Settings > Primary controller > Demand control

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…50 °C	–10 °C
[Curvepoint t 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

A total of 3 types of digital input are available. They are distinguished in the way they handle heat demand signals and in the different setting choices they offer:

- A signal received at input ”Heating curve request 2-pos“ is handled like a heat demand signal from one of the heating circuits. The setpoint is dependent on the outside temperature and determined via the same heating curve as demand control. For more detailed information about demand control, refer to section 8.3 ”Heat demand transformers“
- A signal received at input “DHW request 2-pos“ is handled like a signal from DHW heating. A constant setpoint can be preselected. Also, the priority of the resulting DHW request can be selected. For more detailed information about DHW priority, refer to subsection 5.6.2 “Load control“.
- A signal received at input “Frost prot request 2-pos“ is handled like a heat request resulting from risk of frost. A constant setpoint can be preselected

A heating curve request can be ignored in the summer while consideration is given to frost protection requests, depending on the plant’s state.
Whether the input shall be active with the contact open or closed can be parameterized for each input.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > RMK770.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.

6.5.3 Heat demand transformers

For a description of the heat demand transformers, refer to section 8.3 “Heat demand transformers“

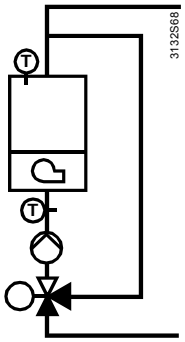
6.6 Other functions

6.6.1 Common maintained boiler return temperature

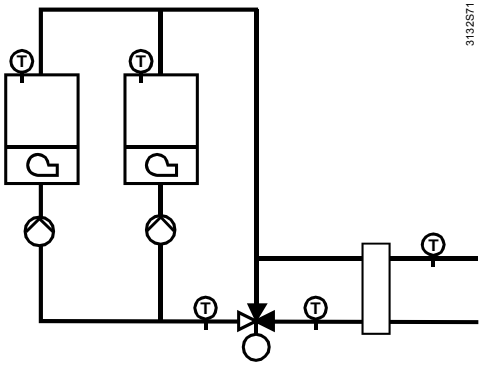
Minimum limitation of the return temperature shall ensure that, by the boiler inlet also, the temperature does not drop below the permissible value. In most cases, this is solved separately on each individual boiler. But it is also possible to perform this function for all boilers from a central location.

With mixing valve

When, in Extra configuration > Boiler sequence, a sensor has been configured for the maintained boiler return temperature and an output for the maintained boiler return temperature (3-position or modulating), the common maintained boiler return temperature is ensured by a mixing valve.
The setpoint of the return temperature is to be configured on submenu Limitations, and the parameters for control on submenu Return control.
For more detailed information about mixing valve control, refer to section 5.7 “Mixing valve control”.



Minimum limitation of the return temperature with separate mixing valve per boiler



Minimum limitation of the return temperature with common mixing valve

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Limitations

Operating line	*Range*	*Factory setting*
MBRT Return temp minimum	---- / 8…140 °C	---- °C

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Return control

Operating line	*Range*	*Factory setting*
Actuator running time	1.0…600.0 s	150 s
P-band Xp	1.0…100.0 K	50 K
Integral action time Tn	0.0…600.0 s	60 s

With effect on the consumers

If only a return temperature sensor without mixing valve has been configured, the system tries to limit the return temperature by influencing the consumers. If the return temperature is too low, load control restricts the amount of heat drawn by the consumers.
For more detailed information, refer to subsection 5.6.2 “Load control”.
The type of locking signals can be selected on submenu Limitations.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Limitations

Operating line	*Range*	*Factory setting*
Lock sig maintained boil ret temp	None / Uncritical / Critical	Critical

The main pump, like the boiler pump, never responds to locking signals.
Whether or not the system pump shall respond to locking signals can be selected on function block “Primary controller”.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Primary controller > Limitations

Operating line	*Range*	*Factory setting*
System pump locking signal	On / Off	Off

6.6.2 Maximum limitation of the flow temperature setpoint

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Limitations

Operating line	*Range*	*Factory setting*
Main flow setpoint max	25…140 °C	95 °C

Using this setting, the flow temperature setpoint, which is calculated by the function block through generation of the maximum value, can be limited at a maximum.

6.6.3 Frost protection

Boiler frost protection

For more detailed information, refer to subsection 7.9.9 “Frost protection for the boiler”.

Plant frost protection

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler sequence manager > Limitations

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

Here, it can be selected whether frost protection for the plant shall act on the main pump. For more detailed information about frost protection for the plant, refer to section 5.3 “Frost protection for the plant”.

Frost protection for the main flow temperature

If the temperature at the main flow temperature sensor TMnFl falls below 5 °C, a heat request of 10 °C is generated. If the temperature at the sensor returns to a level above 7 °C, the function is deactivated. The function is active for a minimum of 5 minutes.

Frost protection for the consumer return temperature

If the temperature at the consumer return temperature sensor TrtCo falls below 5 °C, a heat request of 10 °C is generated. If the temperature at the sensor returns to a level above 7 °C, the function is deactivated. The function is active for a minimum of 5 minutes.

6.7 Diagnostics

The first diagnostic choice is offered by the info pages “Boiler sequence”, “Boiler sequence manager”, “Temperatures” and “Boilers”.
Info page “Boiler sequence“ shows:

- The number of boilers included in the boiler sequence
- The current lead boiler
- The number of boilers released (release ✓)
- Whether the burner operates (off, first stage, second stage, modulating)
- Whether the boiler is faulty

Boiler sequencing						
Addr. no.	1	2	3	4	5	6
Release:		✓	✓	✓	✓	✓
Burner:	—	1	1	2	1	—
Faults:	🔔					

Boiler sequence manager	
	State
	Cause
	Summer operation
	Number of available boilers
Boiler sequence manager	
	Main flow temp actual value
	Main flow temp setpoint
	Main return temp actual value
	MBRT return temp actual value
Boiler 1	
	Actual value boiler temperature
	Boiler temperature setpoint
	State
	Cause
Boiler 2	
	Etc.

Info page “Boiler sequence manager“ shows the relevant temperatures of the boiler sequence.
The info page(s) “Boiler …“ show(s) the relevant temperatures and setpoints of the boiler as well as the state indicating whether the boiler is released.

For detailed diagnostics, the following additional information is provided:

■ Main menu > Boiler sequence manager > Boiler sequence optg mode

Operating line	*Range*	*Factory setting*
Preselection	Off / Summer operation / Auto	Auto
State	Off / On	
Cause		
Summer operation	Inactive / Active	
Boiler sequence selection manual	Auto / 1…6	Auto

or Main menu > Boiler sequence manager > Boiler sequence optg mode

Operating line	*Range*	*Factory setting*
Setp preselection manual	---- / 8…140 °C	---- °C

■ Main menu > Boiler sequence manager > Boiler order

Operating line	*Range*
Number of avail boil	0…6
Address number lead boiler	1…6
Address number 1st lag boiler	1…6
Address number 2nd lag boiler	1…6
Address number 3rd lag boiler	1…6
Address number 4th lag boiler	1…6
Address number 5th lag boiler	1…6

■ Main menu > Boiler sequence manager > Temperatures boilers

Operating line	*Range*
[Boil address no 1] actual temp	…°C
[Boil address no 2] actual temp	…°C
[Boil address no 3] actual temp	…°C
[Boil address no 4] actual temp	…°C
[Boil address no 5] actual temp	…°C
[Boil address no 6] actual temp	…°C

■ Main menu > Boiler sequence manager > Inputs/setpoints

Operating line	*Range*
Main flow temp actual value	…°C
Main flow temp setpoint	…°C
Main return temp actual value	…°C
MBRT return temp actual value	…°C
MBRT return temp minimum	…°C
Consumer return actual value	…°C
Release input	0 / 1 (1 = released)
Heat request modulating	… °C
Heating curve request 2-pos	0 / 1 (1 = request)
DHW request 2-pos	0 / 1 (1 = request)
Frost prot request 2-pos	0 / 1 (1 = request)
Fault text	Fault text for fault input 1
Fault input 1	0 / 1 (1 = fault)
Fault text	Fault text for fault input 2
Fault input 2	0 / 1 (1 = fault)

Operating line	*Range*
Fault text	Fault text for fault input 3
Fault input 3	0 / 1 (1 = fault)
[Main pump] overload	0 / 1 (1 = overload)
[Main pump B] overload	0 / 1 (1 = overload)
Flow signal pump	0 / 1 (0 = no flow)
Optg hours pump	0…99999 h
Optg hours pump B	0…99999 h

When making diagnostics or the wiring test, logic states are displayed. The input is active when 1 appears on the display. If “Normal position open“ is selected, this is the case when the contact is closed; if “Normal position closed“ is selected, this is the case when the contact is open.

■ Main menu > Boiler sequence manager > Outputs

Operating line	*Range*
Mixing valve position	0…100%
Main pump	Off / On
Main pump B	Off / On

■ Main menu > Boiler sequence manager > Limitations

Operating line	*Range*
MBRT return min	Inactive / Active
Setpoint maximum limitation	Inactive / Active

6.8 Fault handling

Fault of main flow and main return sensor

Number	*Text*	*Effect*
330	Main flow sensor error	Urgent message; must be acknowledged and reset, plant stop
331	Main return sensor error	Nonurgent message; must be acknowledged, no plant stop

Fault of main pump

Number	*Text*	*Effect*
2491	[Main pump] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: ”Acknowledge“
2492	[Main pump B] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: ”Acknowledge“
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] fault	Urgent message; must not be acknowledged, plant stop

Fault supervision boiler sequence

Number	*Text*	*Effect*
2391	[Boiler seq] water shortage	Can be parameterized
2392	[Boiler sequence] overpressure	Can be parameterized
2393	[Boiler sequence] underpressure	Can be parameterized

Main flow temperature supervision

Number	*Text*	*Effect*
2396	Main flow temp not reached	Nonurgent, must be acknowledged, no plant stop

Sensor supervision general

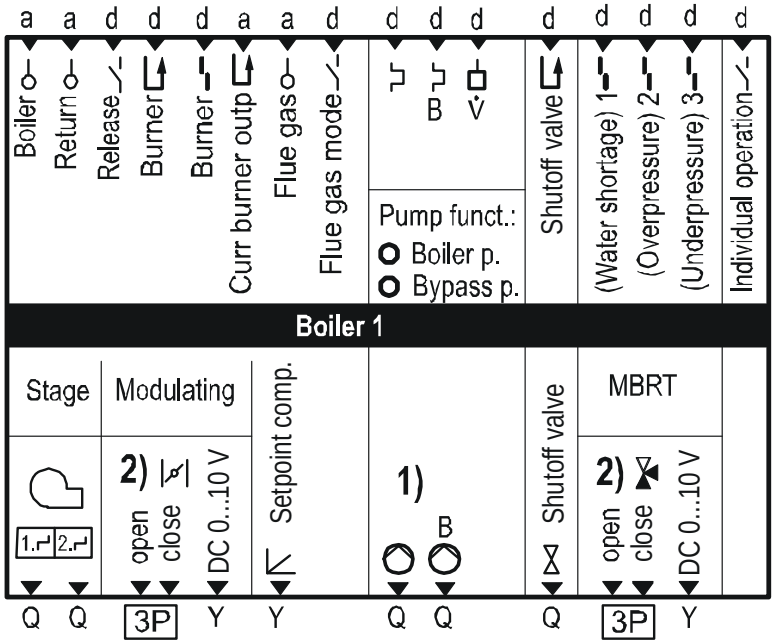
Number	*Text*	*Effect*
332	[Boiler seq] MBRT sensor error	Nonurgent message; must be acknowledged, no plant stop
333	Consumer return sensor error	Nonurgent message; must be acknowledged, no plant stop

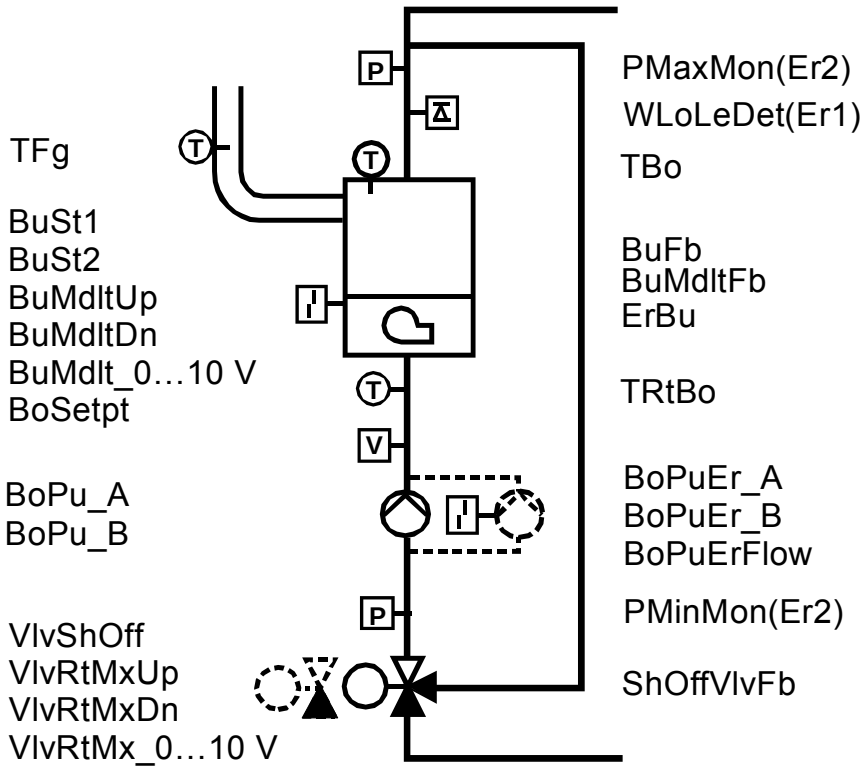
Various faults

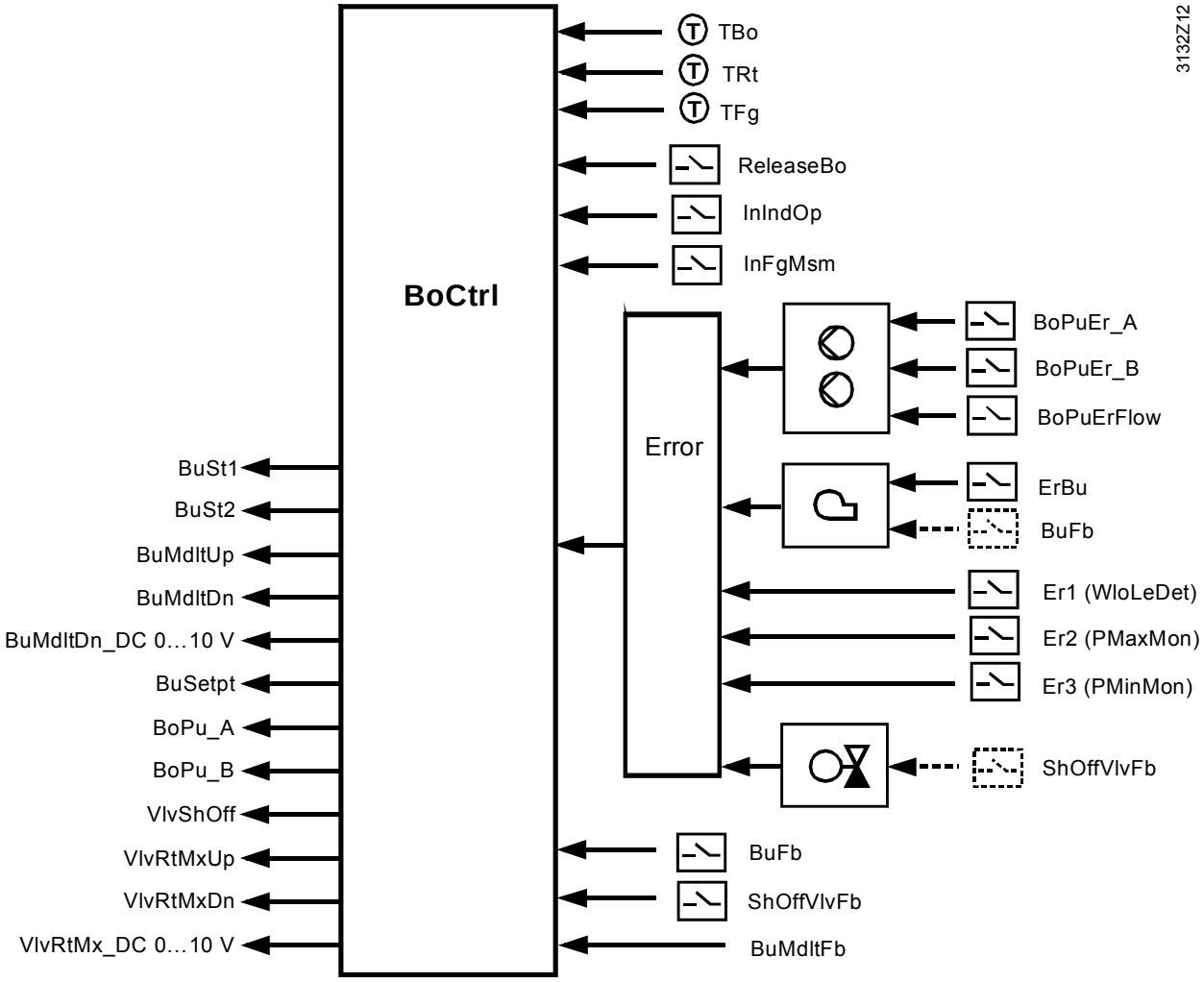
Number	*Text*	*Effect*
5593	Number of boilers wrong setting	Nonurgent message; must not be acknowledged
5594	Invalid lead boiler	Nonurgent message; must not be acknowledged
2202	Main contr h'request mod error	Nonurgent message; must not be acknowledged, no plant stop
5591	Failure boiler sequence manager	Nonurgent message; no plant stop; must be acknowledged
5592	>1 boiler sequence manager	Nonurgent message; no plant stop; must be acknowledged
2300	>1 boiler faulty	Urgent message, must not be acknowledged, no plant stop

7 Boiler control

7.1 Overview of function block







Inputs:

Tbo	Boiler sensor
TrtBo	Return sensor
Release Bo	Release input
BuFb	Checkback signal burner stage
ErBu	Burner fault
BuMdltFb	Current burner output (modulating burner)
TFg	Flue gas sensor
InFgMs	Flue gas measuring mode contact
BoPuEr_A	[Boiler pump] overload
BoPuEr_B	[Boiler pump B] overload
BoPuErFlow	Flow signal pump
ShOffVlvFb	Checkback signal shutoff valve
Er1 (WLoLeDet)	Fault input 1 (water shortage)
Er2 (PMaxMon)	Fault input 2 (maximum pressure)
Er3 (PMinMon)	Fault input 3 (minimum pressure)
InIndOp	Individual operation

Outputs:

BuSt1	Burner stage 1
BuSt2	Burner stage 2
BuMdltUp	Modulating burner, 3-position open
BuMdltDn	Modulating burner, 3-position close
BuMdlt_ DC 0…10 V	Modulating burner, modulating DC 0…10 V
BoSetpt	Setpoint compensation DC 0…10 V
BoPu_A	Boiler pump A
BoPu_B	Boiler pump B
VlvShOff	Shutoff valve
VlvRtMxUp	MBRT 3-position
VlvRtMxDn	MBRT 3-position close
VlvRtMx_DC 0…10 V	MBRT modulating DC 0…10 V

7.2 Configuration

Basic configuration

In the basic configuration, the function block is activated for the application. The type of burner and boiler hydraulics are preselected by choosing the plant type.
For more detailed information, refer to section 3.3 “Basic configuration”.

Main menu > Commissioning > Basic configuration

Operating line	*Range*	*Factory setting*
Plant type	Refer to subsection 3.3.1 “Plant types”	K1.1

Extra configuration

In the extra configuration, the basic configuration can be complemented and/or amended.
Together with the plant type, it is always 2 boilers with the same type of burner and same boiler hydraulics that are selected. There is a choice of 3 types of burner:

- 1-stage
- 2-stage
- Modulating 3-position

If a boiler requires some other type of burner or some other type of boiler hydraulics, appropriate adaptations can be made in the extra configuration.

Example 1

If, with plant type K2.2, burner stage 2 is removed from the first boiler, the 2-stage burner of the first boiler is converted to a 1-stage burner.

Example 2

By assigning an output terminal to burner stage 2 in plant type K2.1, the 1-stage burner is converted to a 2-stage burner.

In the extra configuration, it is also possible to activate additional boilers by configuring a burner stage and a boiler sensor with boiler 3 to a free input and output, for example. Also, in the extra configuration, additional sensors, fault and control inputs can be defined.

Inputs

Main menu > Commissioning > Extra configuration > Boiler ... > Inputs

Operating line	*Adjustable values / remarks*
Boiler sensor	
Return sensor	
Release input	
Checkb signal burner	
Fault burner	
Current burner output	
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	
Individual operation	

Outputs

Main menu > Commissioning > Extra configuration > Boiler ... > Outputs

Operating line	*Adjustable values / 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

With the basic configuration, a boiler temperature sensor is automatically configured for each of the boilers 1 and 2. The boiler temperature sensor is required if the burner shall maintain a boiler temperature setpoint and/or if minimum or maximum limitation of the boiler temperature shall be ensured.

Return sensor

With the plant types that include maintained boiler return temperature with a mixing valve, a return temperature sensor is automatically preconfigured. In these cases, the sensor is a mandatory requirement. In all other cases, the return temperature sensor can be configured for maintained boiler return temperature with bypass pump or 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

Additional supervision of the burner is made possible with the checkback signal burner. If the checkback signal is not received after an adjustable period of time, the burner initiates lockout. With the burner checkback signal, the burner hours run counter is started only after the checkback signal has been received. When there is no checkback signal, the burner hours run counter is started with the output signal for stage 1. In this way, the prepurge time, etc., is also acquired.
Also refer to section 7.13 “Boiler faults”.

Checkback signal shutoff valve

With the help of the checkback signal shutoff valve, the correct functioning of the shutoff valve can be monitored. Also, the burner is started only after the “Open“ position of the shutoff valve has been confirmed by the checkback signal.
If there is no checkback signal, the burner initiates lockout also.
Also refer to section 7.13 “Boiler faults”.

Flue gas temperature sensor

Using the flue gas temperature sensor, the flue gas temperature can be displayed and monitored.
Also refer to section 7.11 “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 respective boiler.
Also refer to section 7.11 “Flue gas temperature supervision”.

Current burner output

Using the checkback signal from a modulating burner (0…1000 Ω, DC 0…10 V), the current burner output can be acquired. It can be used for display purposes and for producing the output balance.

Fault burner This terminal can be used for the burner fault status message.
Also refer to section 7.13 “Boiler faults”.

Fault input 1…3 For additional fault supervisions, there are 3 universal fault inputs available.
Also refer to section 7.13 “Boiler faults”.

Boiler pump overload Fault input for supervision of the boiler pump

Boiler pump B overload Fault input for supervision of boiler pump B in the case of twin pumps.

Flow signal Input for flow supervision of the boiler pump.

Individual operation Control input, used to operate boiler 1 in individual operation.

Also refer to section 7.6 “Individual operation”.

7.2.1 Burner types

By selecting the plant type, the type of burner is predefined for 2 boilers of the boiler sequence.

- Kx.1: 1-stage burner
- Kx.2: 2-stage burner
- Kx.3: Modulating 3-position

The relevant outputs are preconfigured.
The outputs can be changed in the extra configuration.

Burner stage 1 First burner stage or basic stage of a modulating burner.

Burner stage 2 Second burner stage

Modulating 3-position Configuration of a pair of terminals for a modulating 3-position burner.
Available for selection are the remaining free terminal pairs (Q1/Q2, Q3/Q4, Q5/Q6) for the open and the close signal. Normally, special terminal pairs are required (RC unit for radio interference suppression; for more detailed information, refer to subsection 3.3.2 “Terminal assignment and properties of outputs”).

Modulating burner mod 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 also be used 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 main flow temperature.

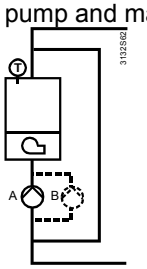
7.2.2 Boiler hydraulics

Definition of pumps

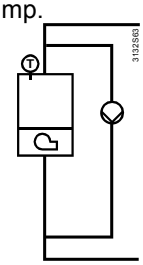
The following pumps are usually present:

- One boiler pump per boiler
- The main pump for all boilers

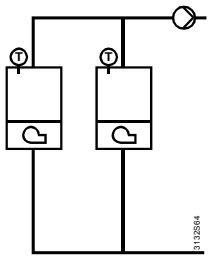
It is also possible to use a boiler pump as a mixing pump or a combination of mixing pump and main pump.



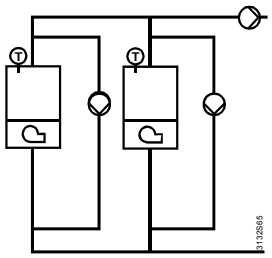
Boiler pump



Boiler mixing pump



Main pump



Boiler mixing pump and main pump

- Plant types K1.x and K2.x use 1 main pump
- Plant type K3.x uses 1 main pump and 1 mixing pump
- Plant types K4.x, K5.x and K6.x use 1 boiler pump

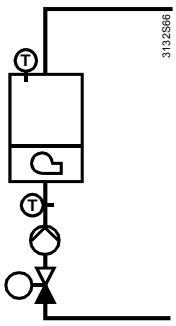
By assigning an output to boiler pump A, a boiler pump is activated for the boiler. In terms of configuration, no difference is made between boiler pump and mixing pump. The function of this pump can be selected: Boiler pump or mixing pump.
Optionally, a twin pump can be used in place of the boiler pump. In that case, in addition to boiler pump A, boiler pump B in the extra configuration must be assigned an output.
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”.

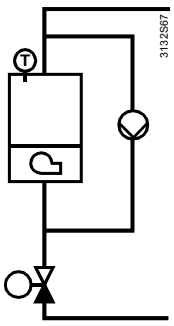
If, in addition, a main pump shall be configured, this must be done on the “Boiler sequence manager” block.

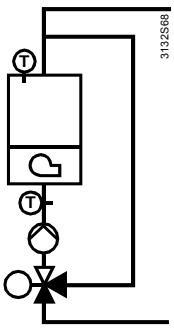
Boiler pump B

Boiler pump B for boiler twin pumps.

Shutoff valve





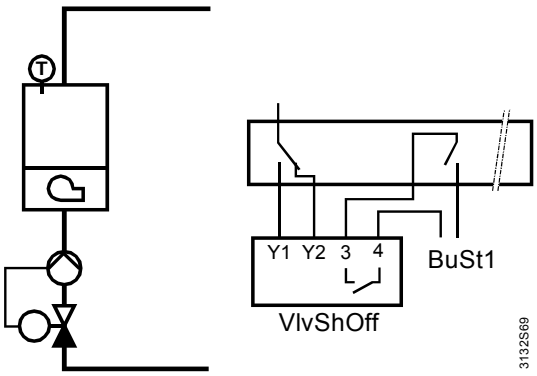


In most cases, every boiler can be hydraulically decoupled by using a shutoff valve.
In the case of plant with a mixing valve for minimum limitation of the return temperature, this function is performed by the mixing valve. If the boiler is not released, the mixing valve is driven to the fully closed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

Shutoff valve

Shutoff valve for hydraulically decoupling the boiler from the system.
With the plant types using shutoff valves, the shutoff valves are configured to terminals with changeover contact so that both an open and a close 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.



If the shutoff valve and the boiler pump are controlled by separate outputs, both boiler pump and burner are switched on only when the shutoff valve is fully open.
If there is a checkback signal from the shutoff valve, it must be configured to input "Checkb signal shutoff valve".
If a checkback signal from the shutoff valve is configured and there is no such checkback signal on completion of the adjusted switch-on delay time, a fault status message is generated. This fault leads to a boiler fault.
For more detailed information, refer to section 7.13 "Boiler faults".
As a variant, it is also possible to only work with the switch-on delay. After control of the shutoff valve, the switch-on delay must elapse for the pump or burner to switch on.

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 is activated on completion of the pump's switch-on delay; then, on completion of the burner's switch-on delay, the burner is released.

Any adjusted overrun time (Settings > Boiler ... > Limitations > Fan overrun time) acts on the boiler pump and the shutoff valve.

Control of shutoff valve

Normally, the shutoff valve is fully open when the relevant boiler is released. If boiler protection function "Maintained boiler return temperature" is used, in which case the boiler is always maintained at the minimum temperature, the behavior of the shutoff valve can be parameterized.
When using the "Open" setting for the shutoff valve (maintained boiler return temperature), the shutoff valve is always opened, even if there is no heat request.
Depending on the type of hydraulic system used, this may not be required (e.g. mixing pump).

Maintained boiler return temperature, 3-position

Configuration of a terminal pair for a 3-position mixing valve. The terminals still available for selection are the free terminal pairs (Q1/Q2, Q3/Q4, Q5/Q6) for the open and the close signal. In general, special terminal pairs must be used for that purpose (RC units for radio interference suppression; for more detailed information, refer to subsection 3.3.2 "Terminal assignment and properties of outputs") .

Maintained boiler return temperature, modulating

DC 0…10 V output for a DC 0…10 V mixing valve actuator.
For more detailed information, also refer to section 7.10 "Minimum limitation of the return temperature".

7.3 Additional boilers

The basic configuration is used to activate 2 boilers for the boiler sequence. If additional boilers are required, they must be configured in the extra configuration.
By assigning a burner stage, the setpoint compensation or a pump to a boiler, the function block of the respective boiler is activated.
For more detailed information, also refer to chapter 3 “Commissioning”.

7.4 Boiler operating modes and boiler setpoints

Plant operation selector enduser

Main menu > Commissioning > Settings > ... or
Main menu > Boiler ... > Boiler operating mode

Operating line	*Range*	*Factory setting*
Preselection	Auto / Off	Auto
State	Released / Off	
Cause	Commissioning / Frost protection for consumer / Overtemp protection/overrun / Frost protection for boiler / Operating mode selector / Protective boiler startup / Release delay burner / Outside temperature lock / Minimum limitation boiler / Test mode / Flue gas measuring mode / Individual operation / Request / No request	

The user can switch off the boiler via operation.
If “Off” is preselected, the internal frost protection function remains active. Heat requests from an external consumer due to frost protection are considered also.

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 is predefined by the boiler sequence manager.
On the Info level, the boiler temperature setpoint and the actual value boiler temperature can be called up.

7.5 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 > Boiler ... > Boiler operating mode

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

Using the digital release input, the boiler remains locked as long as the input is passive.

Frost protection and release input

If the boiler is locked via the release input, setting “Frost protection (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 is put into operation to ensure frost protection

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

Each boiler can also be locked as a function of the outside temperature.
If the **attenuated** outside temperature exceeds the adjusted limit value, the boiler is locked. If the **attenuated** outside temperature drops below the limit value by 1 K, the boiler is released again.

Example

When the outside temperature exceeds 12 °C, boiler 2 shall be locked (too large, the smaller boiler can satisfy the demand for heat).

When the **current** outside temperature drops below the set limit value, the boiler is locked. When it exceeds the limit value by 1 K, the boiler is released again.

Example

When the outside temperature falls below –8 °C, the air-to-water heat pump shall receive no more heat requests (efficient heat pump operation no longer possible).

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Operation settings

Operating line	*Range*	*Factory setting*
Boiler lock outside temp >	---- / 5…30 °C	---- °C
Boiler lock outside temp <	---- / -50…10 °C	---- °C

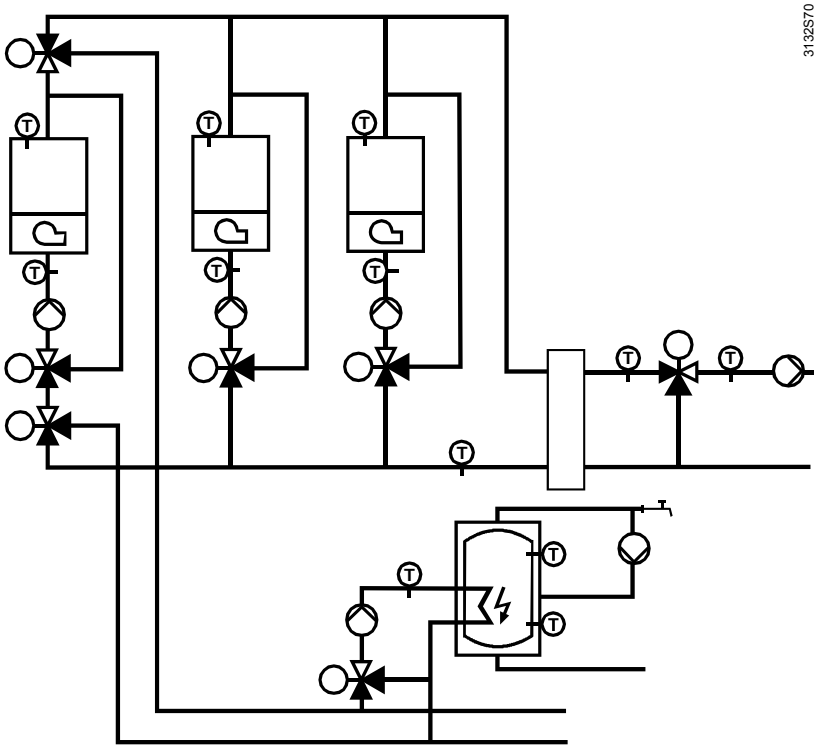
7.6 Individual operation

In the extra configuration, a digital control input for “Individual operation“ can be configured for boiler 1. If that input is active, boiler 1 is controlled to an adjustable setpoint, independent of the boiler sequence manager.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler 1 > Operation settings

Operating line	*Range*	*Factory setting*
Boil setp individual operation	10…95 °C	80 °C

A typical application of individual operation is the separate circuit for DHW heating. With this application, boiler 1 is hydraulically decoupled for DHW heating and, during the time DHW is heated, the boiler temperature setpoint is maintained at a constant level. This application is made possible with individual operation; in that case, hydraulic decoupling from DHW heating must be made separately.



7.7 Test mode and commissioning aids

During commissioning and for test purposes, boiler and 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 / Stage 1 controlled / Stage 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

Test mode is **not** automatically ended (no monitoring of time-out!).

⚠

Only authorized personnel should override the inputs – and for a limited period of time only!

During the test mode, fault status message “Boiler test operation active“ appears. This display is maintained until “Test operation“ is reset to “----“. This ensures that the plant is not quit before test operation is ended.

Entry ----

In position “----“, the boiler is released and receives its presettings from the boiler sequence manager.

Boiler off

The boiler is shut down, that is, burner and pumps are switched off.

Pump on (burner off)

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

Stage 1 controlled

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

Modulating fixed

The boiler is released and the modulating burner operates at the modulation level according to the setting made. The burner is switched off when the maximum limit of the boiler temperature is exceeded.

7.8 Control of the burner

If a boiler temperature sensor is configured, control is provided according to that sensor.

Main menu > Commissioning > Extra configuration > Boiler ... > Inputs

Operating line	*Adjustable values / remarks*
Boiler sensor	Assign input

With the programmed types of plant, a boiler temperature sensor is assigned to each of the 2 boilers. But that sensor can also be removed (---).

Boiler sequence management predefines a boiler temperature setpoint.
Without own boiler temperature sensor, the assumption is made that boiler temperature limitation is ensured by an external boiler temperature limiter. In that case, control uses the main flow sensor as the control sensor. For modulating burner control, a boiler sensor is always required however.

7.8.1 2-position control of 1-stage burners

For 2-position control with a 1-stage burner, the following variables can be adjusted:

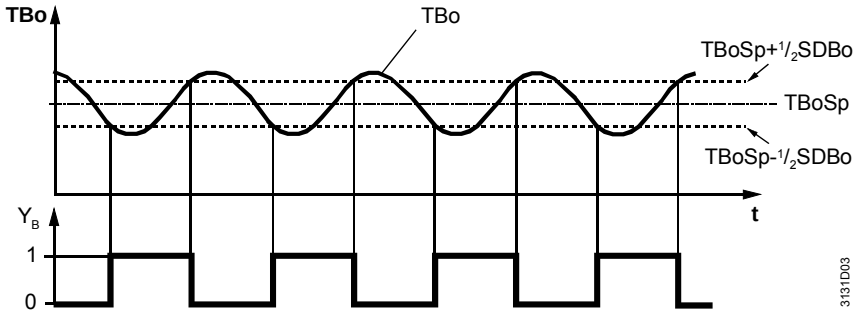
- Boiler switching differential
- Minimum burner running time

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

Boiler switching differential

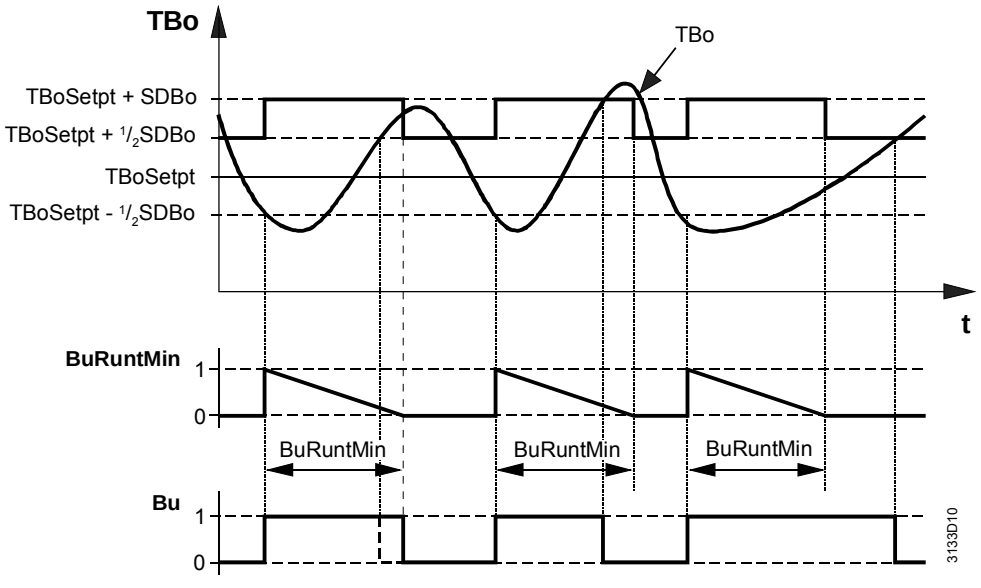
The controller compares the actual value of the boiler temperature with the setpoint. If the boiler temperature drops below the setpoint by half the switching differential, the burner is started up. If the boiler temperature exceeds the setpoint by half the switching differential, the burner is shut down.



SDBo	Boiler switching differential
t	Time
Tbo	Boiler temperature
TboSp	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 is completed, the burner remains in operation until that time has elapsed (burner cycling protection). The minimum burner running time is given priority. The burner's switch-off point is raised by half the boiler's switching differential. If, within the minimum burner running time, the boiler temperature exceeds the setpoint by more than 1 switching differential, the burner is shut down even if the minimum burner running time has not yet elapsed. On completion of the minimum burner running time, the burner's switch-off point is set to the boiler's setpoint plus one half switching differential.



Bu	Burner
BuRuntMin	Minimum burner running time
SDBo	Boiler switching differential
t	Time
Tbo	Boiler temperature
TboSetpt	Boiler temperature setpoint

7.8.2 2-position control of 2-stage burners

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

7.8.3 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 long as stage 2 is released, the calculated switch-on and switch-off points for stage 2 apply.
Exception: The second burner stage is switched off as soon as the boiler temperature has risen to a level where the differential to the maximum boiler temperature represents the setting value "Delta boil temp max" (refer to subsection 7.9.10 "Protection against pressure shocks"). If the maximum boiler temperature is exceeded, the basic stage is also switched off and stage 2 locked.

Burner stage 2

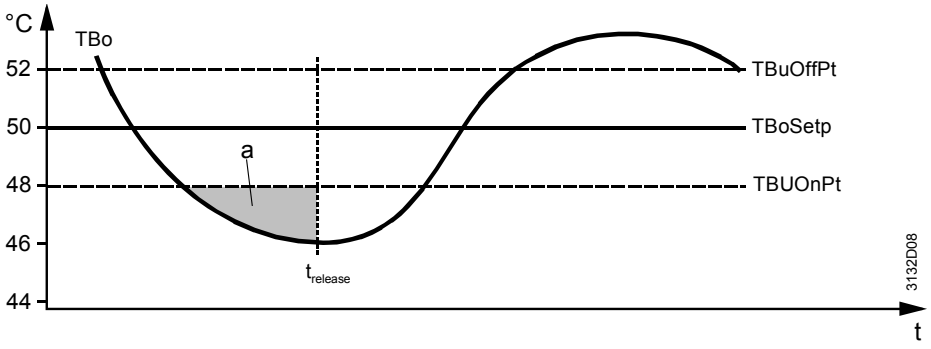
The release logic for 2-stage burner operation aims at ensuring an optimum switch-on time for stage 2 which, in addition to a time criterion, also considers the amount of the heat deficit, calculated with a temperature-time integral.

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 always operates in the basic stage for a 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.

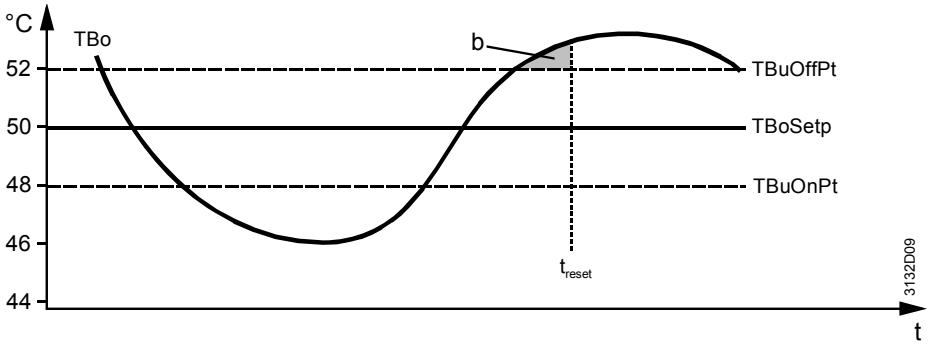


a	Release integral	Tbo	Actual value boiler temperature
TboSetp	Boiler temperature setpoint	t	Time
TbuOffPt	Burner's switch-off temperature	$t_{release}$	Time until release
TbuOnPt	Burner's switch-on temperature		

As long as the boiler temperature lies below the switch-on point – after the basic stage has switched on – the controller builds up the release integral.
When the boiler temperature lies above the switch-on point, the release integral is reduced again. Owing to the performance 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 according to the integral criterion is reached earlier than with a small undershoot.
When the release integral (area "a" in the diagram) has reached the set value of the release integral of stage 2 (point in time $t_{release}$) and the minimum locking time has elapsed, burner stage 2 is released. During the time burner stage 2 is released, the controller switches burner stage 2 according to the switching differential.

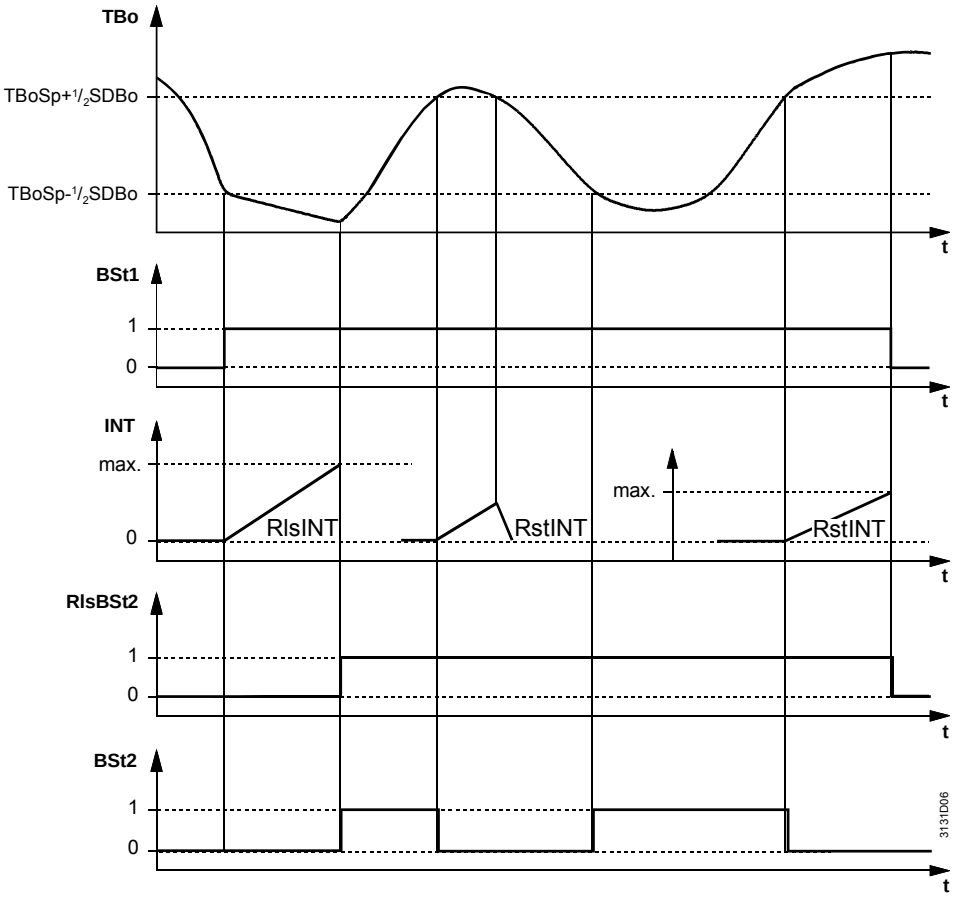
Logic for locking stage 2

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 burner stage 2 has switched off – the controller builds up the reset integral. When the boiler temperature lies below the switch-off point, the reset integral is reduced again. The duration and difference between switch-off point and boiler temperature are summed up.



b	Reset integral	Tbo	Actual value boiler temperature
TboSetp	Boiler temperature setpoint	t	Time
TbuOffPt	Burner switch-off temperature	t reset	Time to reset
TbuOnPt	Burner switch-on temperature		

Owing to the performance 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 is locked earlier. When the reset integral (area “b” in the diagram) has reached the set value of the reset integral of stage 2 (point in time t_{reset}), burner stage 2 is locked and the basic stage switched off.



BSt1	Burner stage 1
BSt2	Burner stage 2
INT	Integral
Rls	Release
Rst	Reset
SD	Switching differential
Sp	Setpoint
t	Time
Tbo	Boiler temperature

Note

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

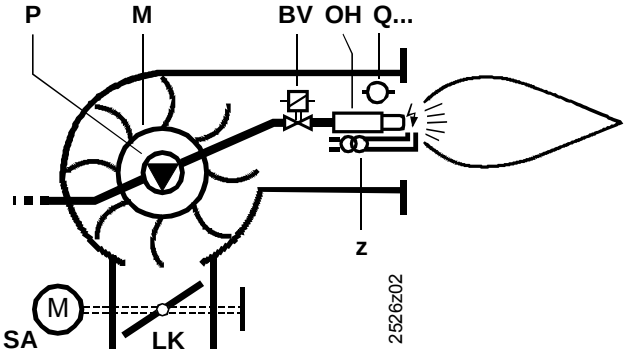
7.8.4 Control of modulating burners

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Burner modulating

Operating line	*Range*	*Factory setting*
Actuator running time	1…600 s	60 s
P-band Xp	1…100 K	20 K
Integral action time Tn	0…600 s	150 s
Derivative action time Tv	0…30 s	5 s

Modulating burners operate in modulating mode only above a certain level (for normal forced draft burners, this limit is 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 is also increased, typically via an additional switch on the air damper, or by simultaneous control of the amount of fuel (gas / fuel 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 with large heavy-oil burners
P	Oil pump, coupled to fan motor
Q…	Flame detector
SA	Air damper actuator for automatic control
Z	Ignition transformer

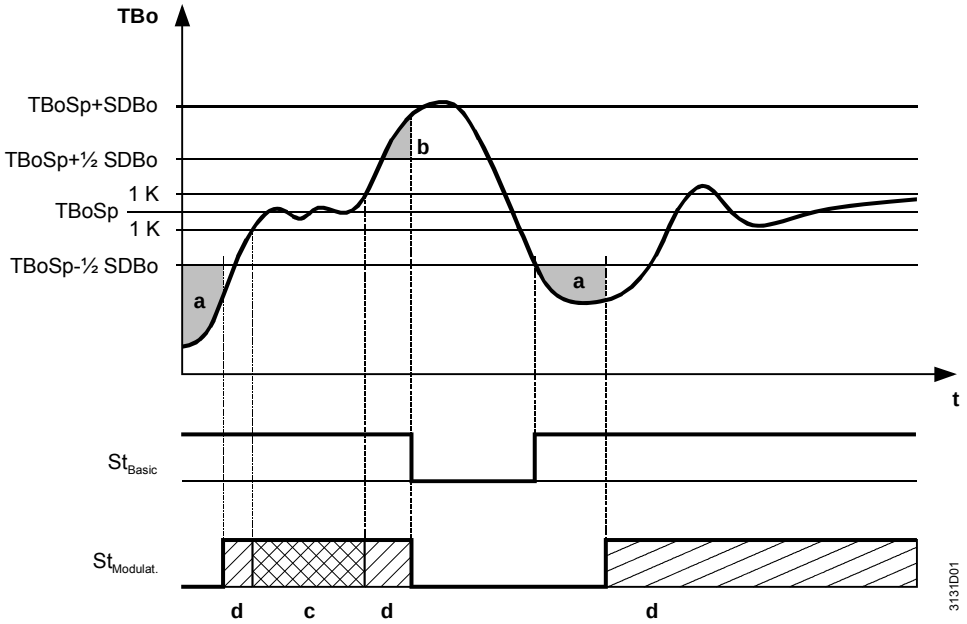
The functioning with regard to activation and deactivation of the basic stage corresponds to that of 2-stage burner operation. Release of modulation takes place analogously to the release of stage 2.
The parameters used for the release and reset integral are the same as those used for the 2-stage burner. 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 larger.

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 burner stage 2	10 min

The locking time (stage 2 or modulation) must be matched to the type of burner.
This ensures that the burner always operates with the basic stage for a certain minimum period of time.

On burner startup and release of the basic stage, the controller drives the damper actuator toward 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 is 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 again drives the damper actuator to the fully closed position.



Release integral for 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 switching differential
St Basic	Burner's basic stage
St Modul.	Burner's modulating stage
t	Time
TboSetp	Boiler temperature setpoint

Neutral zone

The controller uses 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 more than 4 seconds, no more positioning pulses are delivered.
If the boiler temperature does not stay within the neutral zone or outside for a sufficient period of time, positioning pulses drive the actuator toward the fully open or fully closed position.

Maximum limitation of the boiler temperature and minimum burner running time are handled analogous to 2-stage burner operation.

Settings

Air damper control 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 quickly increases heat production in a way that the boiler temperature will only slightly deviate from its setpoint, and for short periods of time only.
The controller has the following positions:

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

Actuator running time

To ensure burner control, the damper actuator's running time must be set. It must be observed that the running time to be set only relates to the modulating range.

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:

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

Proportional band Xp

The proportional band has an impact on the controller's proportional behavior.
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 integral behavior.

Derivative action time Tv

The derivative action time has an impact on the controllers D-behavior. If the derivative action time is set to 0, the controller has only PI behavior.

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 quick. If the control system operates correctly in the upper load range and not satisfactorily in the lower load range (or vice versa), mean values must be used, which may lead to slightly less satisfactory control behavior in the load range that previously showed good performance.
It should be made certain that – when commissioning the modulating burner for the first time – the preset parameters of Xp, Tn and Tv are 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 control behavior with the preset control parameters, the following procedure is recommended:
After the controller has reached and held the setpoint for a certain 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.

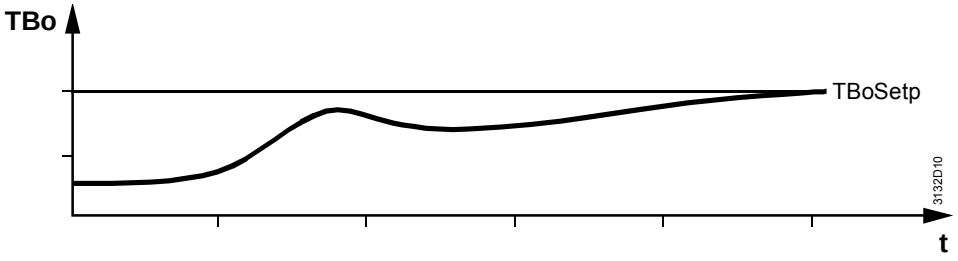
In principle, control must be stable, but it can be fast- or slow-acting.
If fast-acting control is required, the boiler temperature must reach the new setpoint fairly quickly.

If fast control of a setpoint change is not a mandatory requirement, the control action can be rather slow. Nonoscillating control reduces wear on the actuator and on other electromechanical controls used in the plant.

If the control does not produce the required result, the control parameters should be adjusted as follows:

Control action is too slow

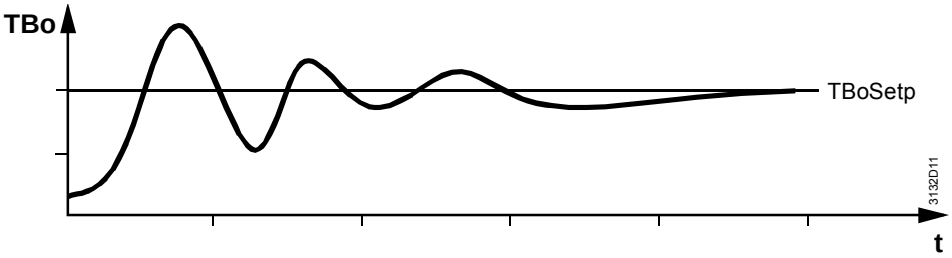
If the control system's response is too slow, setting parameters Xp, Tv and Tn must be decreased in a stepwise fashion. A new readjustment should be made only after the control action resulting from the previous readjustment is completed.



1. Reduce Xp in steps of about 25% of the previous value.
2. Reduce Tv in steps of 1 to 2 seconds (if 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's response is too "hefty" so that it overshoots or starts oscillating, setting parameters Xp, Tn and Tv must be increased in a stepwise fashion. 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.

7.8.5 External burner control

Setpoint compensation

The RMK770 delivers a DC 0…10 V signal as a boiler temperature setpoint for an external boiler temperature controller.

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Outputs > Setpoint comp 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 of the heat demand signal. For setpoints below the limit value, the modulating output delivers a signal of DC 0 V.

7.9 Protective boiler functions

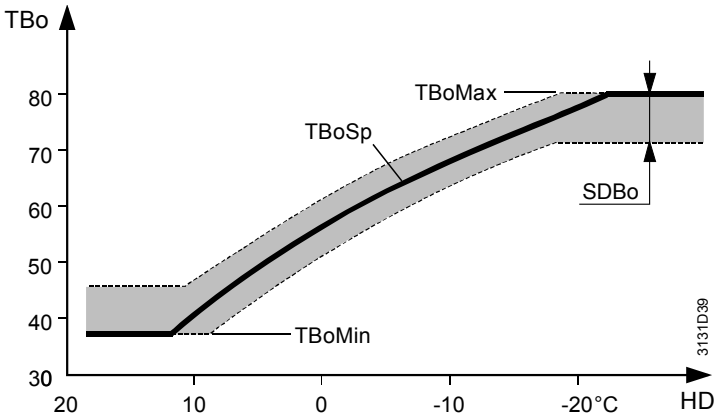
Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler > Limitations

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
Cons overrun time	0…60 min	6 min
Frost protection (release input off)	On / Off	On
Frost prot boiler pump	On / Off	On
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

7.9.1 Maximum limitation of the boiler temperature

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

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



HD	Heat demand
SDB0	Boiler switching differential
Tbo	Boiler temperature
TboMax	Maximum limit of the boiler temperature
TboMin	Minimum limit of the boiler temperature
TboSP	Boiler temperature setpoint

7.9.2 Minimum limitation of the boiler temperature

This setting provides minimum limitation of the boiler temperature setpoint. For burner control, this value represents the switch-on point. In this range, the boiler's switching differential is calculated upward.
The point in time the minimum boiler temperature is maintained depends 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 is set to a level which lies a few Kelvin above the minimum return temperature.

7.9.3 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 does 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 the minimum temperature 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. Therefore protective boiler startup generates critical locking signals but only for the lead boiler (for more detailed information, refer to section 5.6 "Heat demand and load control").

In case of plants with mixing valve for the maintained boiler return temperature, the protective boiler startup function is provided by the mixing valve. In that case, no locking signals for the protective boiler startup is generated.

Boiler pump

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

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Limitations

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

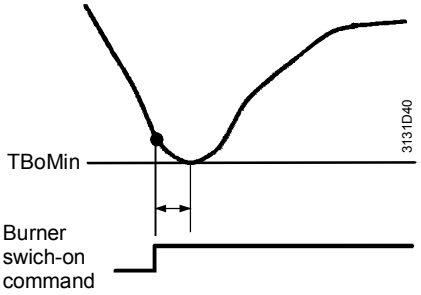
Protective boiler startup and frost protection for the plant

Protective boiler startup can be interrupted by the controller in order to ensure frost protection for the plant in the event the burner initiates lockout, for example.
In the case of simultaneous protective boiler startup and 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. After 15 minutes, protective boiler startup becomes active as soon as the boiler temperature gradient turns positive.

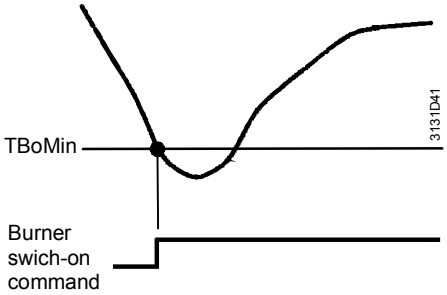
7.9.4 Optimization of the minimum boiler temperature

With setting “Optimization of the minimum boiler temperature = On”), the control selects the switch-on point such that, in normal situations, the boiler temperature does not drop below the minimum level. 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 compensated can be widened.

Based on the boiler temperature gradient, the controller calculates the burner’s switch-on point to ensure that the boiler temperature does not drop below the minimum level. 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

7.9.5 Boiler shutdown

Main menu > Commissioning > Settings > ... *or*
Main menu > Settings > Boiler ... > Operation settings

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

Here, it is possible to select at what point in time minimum limitation of the boiler temperature shall become active.

Without boiler shutdown

Using this setting, the boiler is always maintained at the minimum boiler temperature.

Automatic boiler shutdown

When using this setting, the boiler is operated at the minimum boiler temperature whenever there is a heat request from one of the heat consumers. When there is no heat request, the boiler temperature can drop below its minimum.

Summer

When using the “Summer“ setting, the boiler maintains the minimum temperature only if the boiler sequence manager allows the boiler to run in summer operation.
The boiler also decides to run in summer operation if it did not receive a valid boiler temperature setpoint from the boiler sequence manager for more than 72 hours, or if the outside temperature exceeded a limit value.

7.9.6 Protection against boiler overtemperatures

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 for every boiler.

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 still draw heat for that period of time provided they were consuming heat up to 1 minute before the burner was shut down. In any case, pumps and mixing valves observe 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 the boiler pumps and shutoff valves (including the mixing valve for the maintained boiler return temperature).

7.9.7 Pump kick and valve kick

The pump kick is a protective function that is carried out 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”.

7.9.8 Frost protection for the plant with boiler pump

Here, it can be selected whether frost protection for the plant shall act on the boiler pump. For detailed information about frost protection for the plant, refer to section 5.3 “Frost protection for the plant”.

7.9.9 Frost protection for the boiler

Supervision of the boiler temperature prevents the boiler from freezing up.
When the boiler temperature drops below 5 °C, the burner is switched on; when it returns to a level above TboMin + SD (minimum boiler temperature plus switching differential), the burner is switched off again.

7.9.10 Protection against pressure shocks

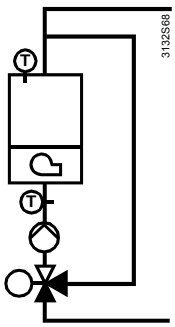
Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Limitations

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

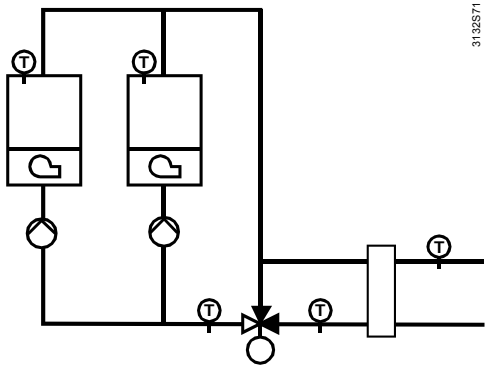
To prevent pressure shocks in the gas network if stages 1 and 2 switch off at the same time, stage 2 is already switched off before the maximum boiler temperature is reached the difference being the setting value “Boiler temp max” stage 2.
When the boiler sequence manager locks a boiler, stage 1 is switched off 10 seconds after stage 2.

7.10 Minimum limitation of the return temperature

Minimum limitation of the return temperature ensures that the return water entering the boiler does not fall below the permissible level.
If adherence to a minimum return temperature is required, it can be ensured either with a bypass pump or mixing valve for maintained return temperature per boiler, a common mixing valve for maintained return temperature for all boilers, or by restricting heat consumption.
Limitation of the return temperature with a common mixing valve or with impact on the consumers is described in subsection 6.6.1 “Common maintained boiler return temperature”.



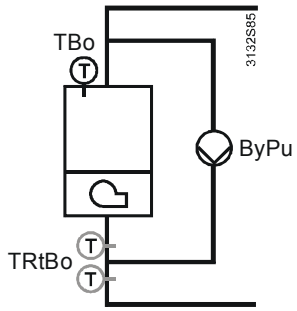
Minimum limitation of the return temperature with separate mixing valve per boiler



Minimum limitation of the return temperature with common mixing valve

Maintained boiler return temperature with bypass pump

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



The bypass pump can be controlled either according to the acquired return temperature or – if no sensor is installed – at the same time the burner is running.

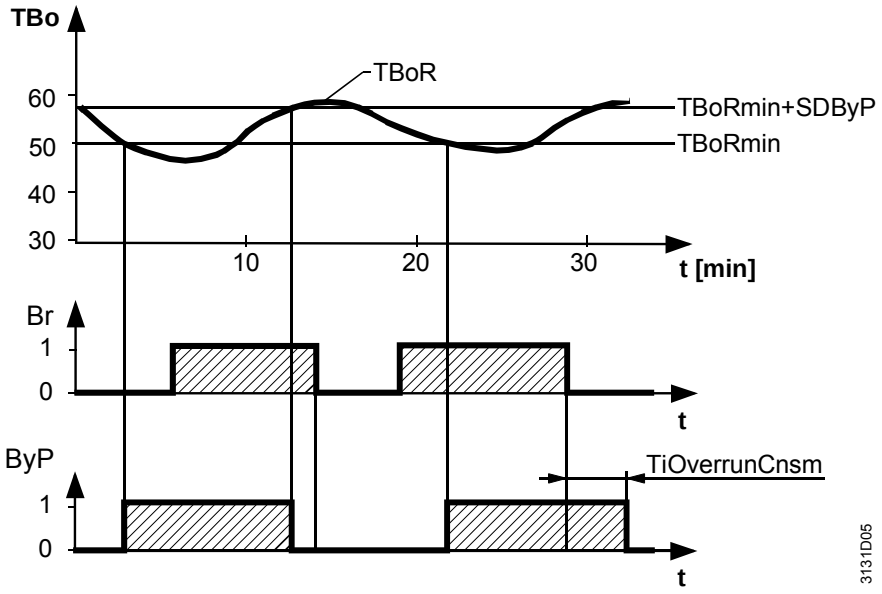
Normally, the return temperature sensor is installed upstream of the bypass pump to prevent the pump from cycling.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Bypass pump switching diff	1…20 K	6 K

The bypass pump controls the return temperature in 2-position mode within the adjustable switching differential.
The pump is activated when there is demand for heat and when the return temperature drops below its minimum limit value.
The pump is 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

When the burner shuts down, pump overrun (refer to section 5.4 “Pump overrun and mixing valve overrun“) also acts on the bypass pump.

Bypass pump control parallel to burner operation

If no return sensor is installed, the bypass pump operates at the same time as the burner. The bypass pump always runs when released and when the burner’s basic stage operates.

Maintained boiler return temperature controlled by mixing valve

If minimum limitation of the return temperature shall be provided with a mixing valve per boiler, the mixing valve must be configured. With plant types K6.x, that mixing valve with a 3-position actuator is preconfigured; with the other types of plant, the mixing valve and the return temperature sensor can be added in the extra configuration.

Main menu > Commissioning > Extra configuration > Boiler ... > Outputs

Operating line	*Adjustable values / remarks*
Maint boiler return temp 3-pos	Assign output
Maint boiler return temp mod	Assign output

Main menu > Commissioning > Extra configuration > Boiler ... > Inputs

Operating line	*Adjustable values / remarks*
Return temperature sensor	Assign input

Configuration of a pair of terminals for a 3-position mixing valve

The terminals still available for selection are the free terminal pairs (Q1/Q2, Q3/Q4, Q5/Q6) for the open and the close signal. Normally, special terminal pairs are required for that purpose (RC units for radio interference suppression; for more detailed information, refer to subsection 3.3.2 “Terminal assignment and properties of outputs”).
By selecting “Maint boiler return temp mod“, a mixing valve with DC 0…10 V output is assigned. If required, this output can be matched to the type of mixing valve used.

Return temperature setpoint

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Limitations

Operating line	*Range*	*Factory setting*
Boiler return temperature min	---- / 8…140 °C	---- °C

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 running time	1…600 s	150 s
P-band Xp	1…100 K	50 K
Integral action time Tn	0…600 s	60 K

If a minimum return temperature shall be ensured, it is necessary to select the minimum boiler temperature accordingly. The minimum boiler temperature must be at least a few K higher than the minimum return temperature.

Fault of return temperature sensor

In the case of plant with a mixing valve for the maintained boiler return temperature, the mixing valve is driven to the fully closed position if the return temperature sensor is faulty and then deenergized to make possible manual adjustment.

If no return temperature sensor is configured, a fault status message appears.
If only a return temperature sensor is configured with no mixing valve present, the sensor is used for display purposes.

7.11 Flue gas temperature supervision

If the flue gas temperature shall be monitored, a sensor must be configured in the extra configuration.

Main menu > Commissioning > Extra configuration > Boiler ... > Inputs

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

It is to be noted here that for the temperature inputs, a Ni1000 sensor is configured as standard. However, for flue gas temperature measurements, Pt1000 sensors are often used; for this reason, Pt1000 is set here as a default value. The type of sensor can be adapted under Settings > Inputs at the configured terminal.
As a result of the sensor’s configuration, the following functions are made available:

Slave pointer function

This function is active whenever a flue gas temperature sensor is selected.

Main menu > Boiler ... > Inputs/setpoints

Operating line	*Range*
Flue gas temperature maximum	---- / 8…400 °C

It is always the maximum flue gas temperature that is saved and displayed. On the menu line that shows the value, the value can be reset to “----“ (representing 8 °C) so that the current value is adopted again.

The maximum value is filtered to suppress faults. As a result, the maximum flue gas temperature rises at the rate of maximum 1 K/s.

Supervision of the maximum value

If a flue gas temperature limit value is parameterized, a fault status message is delivered when the limit value is crossed.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Fault settings > Flue gas temperature supervision

Operating line	*Range*	*Factory setting*
Flue gas temperature limit value	---- / 8…400 °C	---- °C

When the flue gas temperature lies 5 K below that maximum flue gas temperature, the fault status message can be reset by acknowledging it. When resetting, the slave pointer valve is also reset to the current value.

Supervision of the maximum value and boiler stop

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Fault settings > Flue gas temperature supervision

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

If a flue gas temperature limit value is monitored, it is also possible to define if 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 / remarks*
Flue gas temperature	---- / 8…400 °C
Flue gas temperature maximum	---- / 8…400 °C

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

7.12 Flue gas measuring mode

Flue gas measurement can be triggered 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		

If the function is activated with one of the boilers, all boilers in the boiler sequence are shut down. With the relevant boiler, the boiler pump and the peripheral devices are 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 period of time the “Flue gas measuring mode“ function is performed, supervision of the maximum flue gas temperature does not lead to a plant stop. However, if the maximum flue gas temperature is exceeded, a fault status message is delivered.
The function will be aborted after 30 minutes.

7.13 Boiler faults

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

- Fault of burner
- Fault of boiler pump
- Fault of shutoff valve (no checkback signal)
- Maximum flue gas temperature exceeded (if plant stop is required)
- One of the 3 binary fault inputs reports a fault (if plant stop is required)
- Faulty boiler temperature sensor

Main menu > Commissioning > Extra configuration > Boiler ... > Inputs

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

Normal position of fault input

The normal position of the fault input can be parameterized at the respective terminal.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs

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

Fault burner

A burner fault can be signaled 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 status message is delivered.

Maximum flue gas temperature

It can be selected whether or not crossing of the maximum flue gas temperature shall lead to a fault with boiler stop.

Binary fault inputs

There are 3 binary fault inputs available which, with the default parameters, are used for water shortage, high-pressure and low-pressure.
But it is also possible to use other fault text.
Depending on the kind of fault, the fault status signal delay, the fault acknowledgement, the priority and/or the effect 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"".

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 > Checkb 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 > 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 > 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 / Nonurgent	Nonurgent

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Fault settings > Fault input 1

Operating line	*Range*	*Factory setting*
Fault text	A…Z	Water shortage
Impact of fault	No stop / Stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Nonurgent	Urgent
Fault status signal 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 text	A…Z	Overpressure
Impact of fault	No stop / Stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Nonurgent	Urgent
Fault status signal 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 text	A…Z	Underpressure
Impact of fault	No stop / Stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Nonurgent	Urgent
Fault status signal delay	00.00…59.55 m.s	00.05 m.s

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

Fault supervision boiler pump

For more detailed information, refer to section 5.8 “Pump control”

7.14 Burner hours run counter and output balance

For stage 1 or the basic stage, a checkback signal can be configured.
This checkback signal can be used for the burner hours run counter, the burner start counter, and for calculating the output balance.
When there is no checkback signal, the burner hours run counter is started by the output relay of stage 1. When burner stage 2 or modulation is released, the number of operating hours of stage 2 or modulation are counted.

Main menu > Commissioning > Extra configuration > Boiler ... > Inputs

Operating line	*Adjustable values / remarks*
Checkb signal burner	Assign input
Current burner output	Assign input (for modulating burners)

With modulating burners, the current position of the air damper can be fed back via potentiometer (0…1000 Ω) or DC 0…10 V signal. This checkback signal is also used for computing the output balance. If there is no checkback signal, the positioning model is used.
To produce an output balance, the boiler sequence manager requires the current output of each boiler.
Based on the set rated capacity and the output proportion of stage 1, the boiler computes the current output as a function of the cycling ratio of stage 1 or stage 2, or depending on the degree of modulation of the modulating burner.
When setting the rated capacity, the boiler’s efficiency can be taken into consideration. But this is of importance only if the boilers contained in the boiler sequence have different efficiencies. Apart from that, the proportions of the individual boiler outputs are of importance.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Burner

Operating line	*Range*	*Factory setting*
Boiler output	1…10000	100 kW
Proportion stage 1	0…100%	60%

With 1-stage burners, 100% is automatically used.
In the case of a 2-stage burner, the proportion of stage 2 is the difference between 100% and the proportion of stage 1.
The number of burner hours run and the number of burner starts are shown at menu item Inputs/setpoints. On the user level, they can only be read; on the service level, they can also be adjusted. It is thus possible to set the effective values.

Main menu > Commissioning > Settings > ... or
Main menu > Boiler ... > Inputs/setpoints

Operating line	*Range*	*Factory setting*
Hours run stage 1	0…99999 h	0 h
Hours run stage 2	0…99999 h	0 h
Burner start counter	0…99999	0

7.15 Fault status messages

Note

This section 7.15 shows the text for each fault number with which the controller is supplied. It can be changed on the password level.

Fault boiler temperature sensor

Number	*Text (as supplied)*	*Effect*
301	[Boiler 1] boiler sensor error	Urgent message; must be acknowledged. No boiler stop
302	[Boiler 2] boiler sensor error	Urgent message; must be acknowledged. No boiler stop
303	[Boiler 3] boiler sensor error	Urgent message; must be acknowledged. No boiler stop
304	[Boiler 4] boiler sensor error	Urgent message; must be acknowledged. No boiler stop
305	[Boiler 5] boiler sensor error	Urgent message; must be acknowledged. No boiler stop
306	[Boiler 6] boiler sensor error	Urgent message; must be acknowledged. No boiler stop

If the boiler temperature sensor is faulty, the burner is shut down.

Fault return temperature sensor

Number	*Text (as supplied)*	*Effect*
311	[Boiler 1] return sensor error	Nonurgent message; must be acknowledged. No boiler stop
312	[Boiler 2] return sensor error	Nonurgent message; must be acknowledged. No boiler stop
313	[Boiler 3] return sensor error	Nonurgent message; must be acknowledged. No boiler stop
314	[Boiler 4] return sensor error	Nonurgent message; must be acknowledged. No boiler stop
315	[Boiler 5] return sensor error	Nonurgent message; must be acknowledged. No boiler stop
316	[Boiler 6] 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 is driven to the fully closed position when there is no return temperature sensor and then deenergized to make possible manual adjustment.

Otherwise, the control behaves like a plant without return temperature sensor.

Fault flue gas temperature sensor

Number	*Text (as supplied)*	*Effect*
321	[K1] flue gas temp sensor error	Nonurgent message; must be acknowledged. No boiler stop
322	[K2] flue gas temp sensor error	Nonurgent message; must be acknowledged. No boiler stop
323	[K3] Flue gas temp sensor error	Nonurgent message; must be acknowledged. No boiler stop
324	[K4] flue gas temp sensor error	Nonurgent message; must be acknowledged. No boiler stop
325	[K5] flue gas temp sensor error	Nonurgent message; must be acknowledged. No boiler stop
326	[K6] flue gas temp sensor error	Nonurgent message; must be acknowledged. No boiler stop

Fault burner

Number	*Text (as supplied)*	*Effect*
2301	[K1 burner] fault	Urgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. Boiler stop
2302	[K2 burner] fault	Urgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. Boiler stop
2303	[K3 burner] fault	Urgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. Boiler stop
2304	[K4 burner] fault	Urgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. Boiler stop
2305	[K5 burner] fault	Urgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. Boiler stop
2306	[K6 burner] fault	Urgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. Boiler stop

Fault burner operation supervision

Number	*Text (as supplied)*	*Effect*
2311	[K1 burner] no checkback signal	Urgent message; must be acknowledged and reset. Effect can be parameterized; factory setting: “Stop“ (boiler stop)
2312	[K2 burner] no checkback signal	Urgent message; must be acknowledged and reset. Effect can be parameterized; factory setting: “Stop“ (boiler stop)
2313	[K3 burner] no checkback signal	Urgent message; must be acknowledged and reset. Effect can be parameterized; factory setting: “Stop“ (boiler stop)
2314	[K4 burner] no checkback signal	Urgent message; must be acknowledged and reset. Effect can be parameterized; factory setting: “Stop“ (boiler stop)
2315	[K5 burner] no checkback signal	Urgent message; must be acknowledged and reset. Effect can be parameterized; factory setting: “Stop“ (boiler stop)
2316	[K6 burner] no checkback signal	Urgent message; must be acknowledged and reset. Effect can be parameterized; factory setting: “Stop“ (boiler stop)

Water shortage

Number	*Text (as supplied)*	*Effect*
2321	[Boiler 1] water shortage	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2322	[Boiler 2] water shortage	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2323	[Boiler 3] water shortage	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged

Number	*Text (as supplied)*	*Effect*
2324	[Boiler 4] water shortage	Priority, effect and acknowledgement can be parameterized. Supply state Urgent, boiler stop, must be acknowledged
2325	[Boiler 5] water shortage	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2326	[Boiler 6] water shortage	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged

Overpressure

Number	*Text (as supplied)*	*Effect*
2331	[Boiler 1] overpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2332	[Boiler 2] overpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2333	[Boiler 3] overpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2334	[Boiler 4] overpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2335	[Boiler 5] overpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2336	[Boiler 6] overpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged

Underpressure

Number	*Text (as supplied)*	*Effect*
2341	[Boiler 1] underpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2342	[Boiler 2] underpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2343	[Boiler 3] underpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged

Number	*Text (as supplied)*	*Effect*
2344	[Boiler 4] underpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2345	[Boiler 5] underpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged
2346	[Boiler 6] underpressure	Priority, effect and acknowledgement can be parameterized. Supply state: Urgent, boiler stop, must be acknowledged

Fault checkback signal shutoff valve

Number	*Text (as supplied)*	*Effect*
2351	[K1 valve] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 1
2352	[K2 valve] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 2
2353	[K3 valve] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 3
2354	[K4 valve] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 4
2355	[K5 valve] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 5
2356	[K6 valve] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 6

Flue gas temperature limit exceeded

Number	*Text (as supplied)*	*Effect*
2361	[K1] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Nonurgent, no boiler stop, must be acknowledged and reset
2362	[K2] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Nonurgent, no boiler stop, must be acknowledged and reset
2363	[K3] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Nonurgent, no boiler stop, must be acknowledged and reset
2364	[K4] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Nonurgent, no boiler stop, must be acknowledged and reset
2365	[K5] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Nonurgent, no boiler stop, must be acknowledged and reset
2366	[K6] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Nonurgent, no boiler stop, must be acknowledged and reset

Overload boiler pump

Number	*Text (as supplied)*	*Effect*
2401	[K1 pump] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2402	[K2 pump] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2403	[K3 pump] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2404	[K4 pump] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2405	[K5 pump] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2406	[K6 pump] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop

Flow fault boiler pump

Number	*Text (as supplied)*	*Effect*
2411	[K1 pump] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2412	[K2 pump] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2413	[K3 pump] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2414	[K4 pump] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2415	[K5 pump] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2416	[K6 pump] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop

Overload boiler pump B

Number	*Text (as supplied)*	*Effect*
2421	[K1 pump B] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2422	[K2 pump B] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2423	[K3 pump B] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2424	[K4 pump B] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2425	[K5 pump B] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop
2426	[K6 pump B] overload	Nonurgent message; acknowledgement can be parameterized; factory setting: “Acknowledge“. No boiler stop

Flow fault boiler pump B

Number	*Text (as supplied)*	*Effect*
2431	[K1 pump B] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2432	[K2 pump B] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2433	[K3 pump B] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2434	[K4 pump B] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2435	[K5 pump B] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2436	[K6 pump B] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop

Failure boiler pump

Number	*Text (as supplied)*	*Effect*
2441	[Boiler 1 pump] fault	Urgent message; must not be acknowledged and reset. Boiler stop
2442	[Boiler 2 pump] fault	Urgent message; must not be acknowledged and reset. Boiler stop
2443	[Boiler 3 pump] fault	Urgent message; must not be acknowledged and reset. Boiler stop
2444	[Boiler 4 pump] fault	Urgent message; must not be acknowledged and reset. Boiler stop
2445	[Boiler 5 pump] fault	Urgent message; must not be acknowledged and reset. Boiler stop
	[Boiler 6 pump] fault	Urgent message; must not be acknowledged and reset. Boiler stop

Test mode active

Number	*Text*	*Effect*
2371	Boiler test mode active	Nonurgent message; must not be acknowledged

7.16 Boiler designations

Each boiler can be assigned a specific boiler designation.
The overview on the info page continues to use the boiler nos., but the boiler-specific info page uses the boiler designations.
The menu also makes use of the boiler designations entered here.

Example boiler

Main menu > Commissioning > Settings ...
Main menu > Settings > Boiler 2

Operating line	*Range*	*Factory setting*
Boiler 2	Text A…Z	Boiler 2

7.17 Diagnostic choices

Main menu > Boiler ... > Inputs/setpoints

Operating line	*Adjustable values / remarks*
Release input	0 / 1 (1 = released)
Individual operation	With boiler 1 only
Boiler temperature actual value	… °C
Boiler temperature setpoint	… °C
Actual value return temp	… °C
Return temperature min	… °C

Operating line	*Adjustable values / remarks*
Checkb sign shutoff valve	0 /1 (1 = checkback signal)
[Boiler pump] overload	0 / 1 (1 = overload)
[Boiler pump B] overload	0 / 1 (1 = overload)
Flow signal pump	0 / 1 (0 = no flow)
Optg hours pump	0…99999 h
Optg hours pump B	0…99999 h
Fault burner	0 / 1 (1 = fault)
Checkback signal burner	0 /1 (1 = checkback signal)
Hours run stage 1	0…99999 h
Hours run stage 2	0…99999 h
Burner start counter	0…99999
Current burner output	0…100 %
Flue gas temperature	… °C (current value)
Flue gas temperature max	… °C (maximum value of slave pointer)
Flue gas temperature limit value	… °C (limit value fault triggering)
Flue gas meas mode contact	0 / 1 (1 = flue gas measuring mode)
Fault text	Fault text for fault input 1
Fault input 1	0 / 1 (1 = fault)
Fault text	Fault text for fault input 2
Fault input 2	0 / 1 (1 = fault)
Fault text	Fault text for fault input 3
Fault input 3	0 / 1 (1 = fault)
Attenuated outside temp	… °C

When making diagnostics or the wiring test, logic states are displayed. The input is active when 1 appears on the display. If “Normal position open“ is selected, this is the case when the contact is closed; if “Normal position closed“ is selected, this is the case when the contact is open.

■ Main menu > Boiler ... > Outputs

Operating line	*Adjustable values / remarks*
Burner stage 1	Off / On
Burner stage 2	Off / On
Signal modulating burner	0…100%
Setpoint compensation	0…100%
Boiler pump	Off / On
Boiler pump B	Off / On
Shutoff valve	Closed / Open
Mix valve pos maint return temp	0…100%

■ Main menu > Boiler ... > Limitations

Operating line	*Adjustable values / remarks*
Boiler temperature max	Inactive / Active
Boiler temperature min	Inactive / Active
Protective boiler startup	Inactive / Active
Boiler return temperature min	Inactive / Active
Burner running time min	Inactive / Active

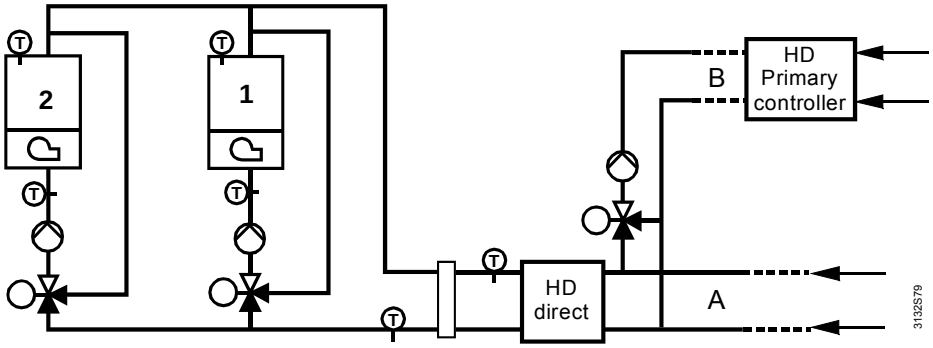
8 Heat demand and heat requests

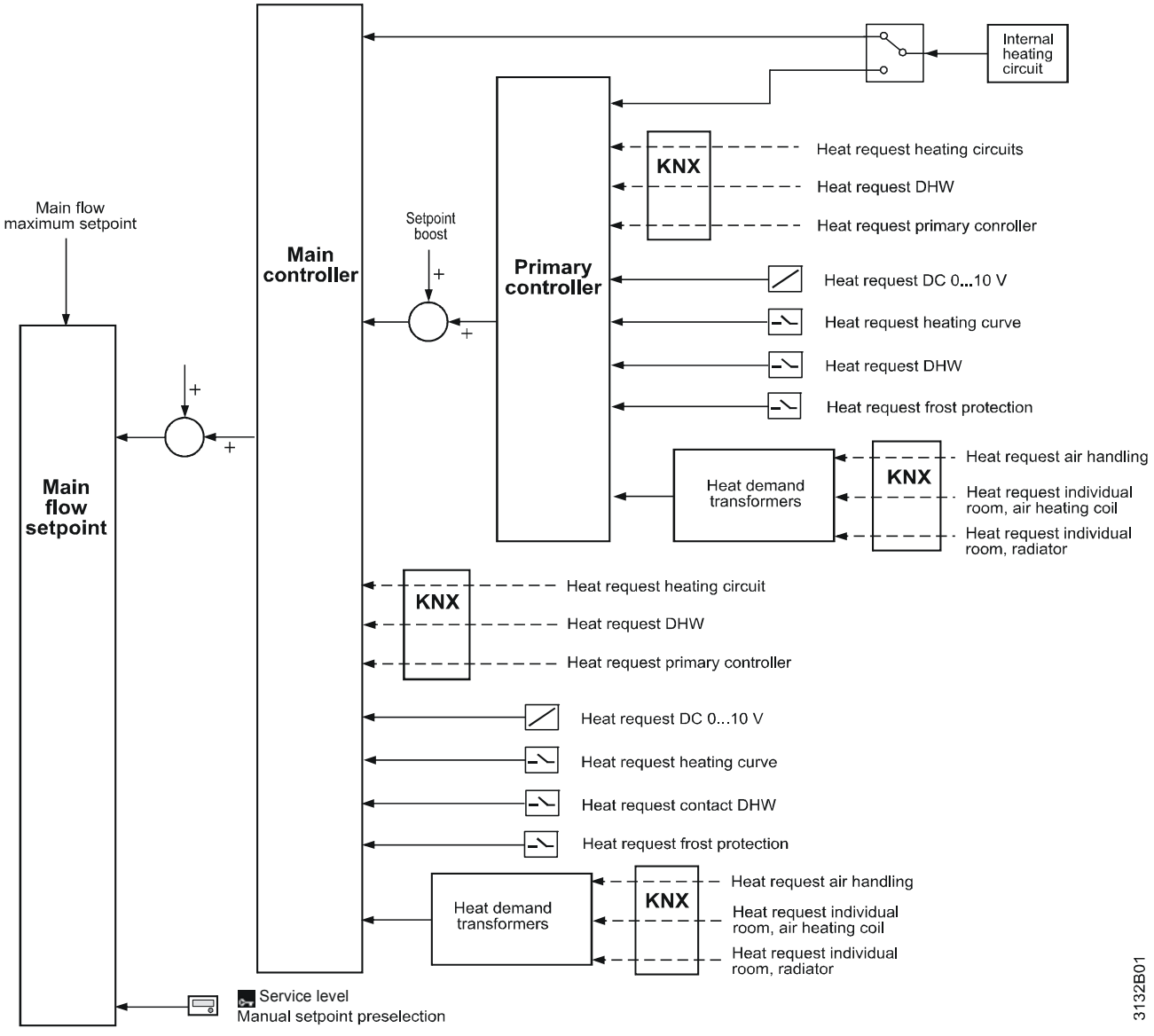
8.1 Heat requests

The controller can receive heat requests:

- From the internal heating circuit
- From external controllers (KNX) via bus
- As continuous DC 0…10 V signals
- As 2-position signals

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





Notes

Direct delivery is described in chapter 6 “Boiler sequence management” and delivery via the primary controller in chapter 9 “Precontrol”.
The special case of weather-dependent setpoint compensation for boiler sequencing is described in the following section.

8.2 Weather-compensated setpoint for boiler sequencing

There may be a need to operate the boiler sequence according to a weather-compensated setpoint without having a heating circuit. This can be the case if, for example, a great effort would be required to integrate existing consumer circuits into the new system.
In this case, a virtual heating circuit can be used.
This virtual heating circuit predefines a weather-compensated flow temperature setpoint for the boiler sequence manager, including all choices offered by function block “Heating circuit”.
It is thus possible to use the time program, for example, or the digital input for changeover of the heating circuit mode to switch between no heat request and weather-compensated heat request.

Example

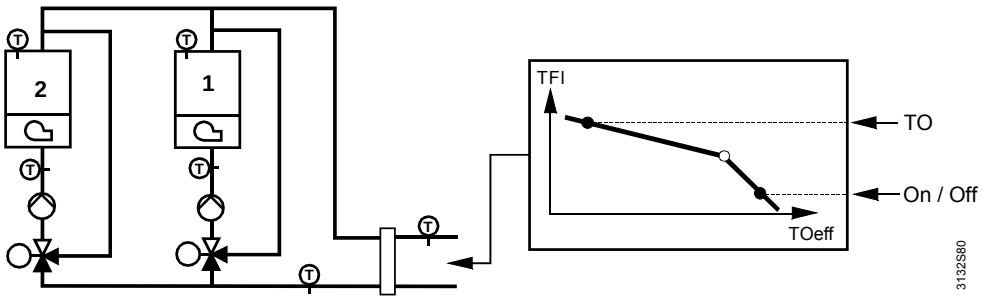
If the digital input for the room operating mode is used, it is possible to select the operating mode employed when the contact is active.

If, with the active operating mode, Comfort mode shall apply, room operating mode Protection must be selected for the heating circuit. This ensures that, depending on the contact position, heat demand for the boiler sequence is switched between the weather-compensated flow temperature setpoint for Comfort mode and Protection.

To activate the virtual heating circuit, the “Heating circuit” setting in the extra configuration must be parameterized to “Active“. In addition, the outside temperature is required. This can be configured in function block “Miscellaneous”. The outside temperature can also be acquired via KNX bus. For more detailed information, refer to subsection 14.5.2 “Outside temperature”.

Main menu > Commissioning > Extra configuration > Heating circuit

Operating line	*Range*	*Factory setting*
Virtual heating circuit	Active / Inactive	Inactive



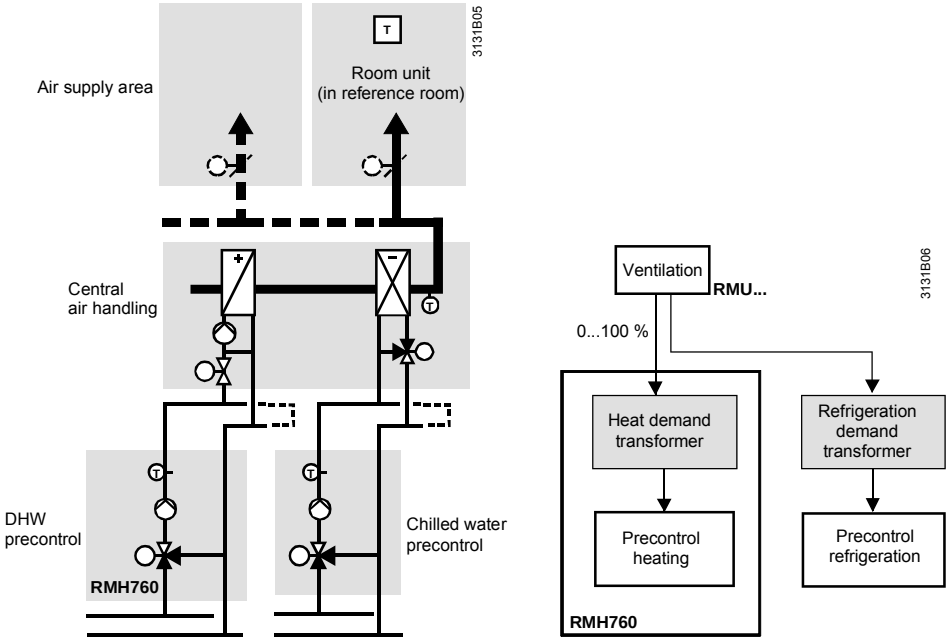
8.3 Heat demand transformers

Heat demand transformers are available with both the main header and the primary controller. They receive and handle the requests from:

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

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

Example:
Air handling plant



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

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

The maximum flow temperature readjustment can be parameterized.

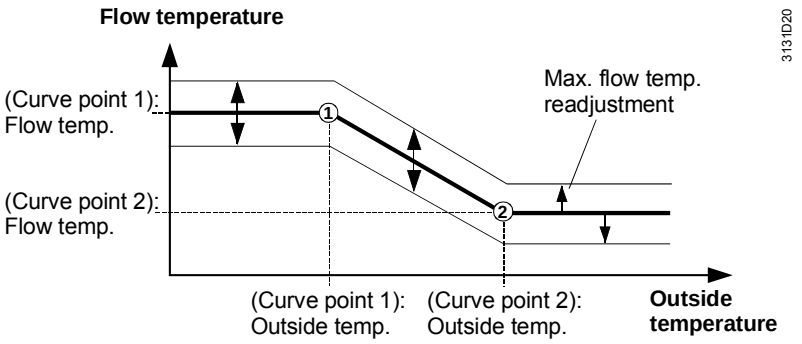
To ensure that minimum opening travel of the valve does not produce a demand for heat, a switch-off threshold can be defined.

- Demand for heat is computed only if the valve positions exceed “Threshold on”
- If the valve positions of all consumers are below “Threshold off“, the demand for heat is suppressed again

Main menu > Commissioning > Settings > … or
Main menu > Settings > Boiler sequence manager > 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
Flow temp correction max	0…100 K	10 K
Control action	Slow / Medium / Fast	Medium
Request evaluation	Maximum / Average	Maximum
Limit value request on	(Threshold off)…100%	10 %
Limit value request off	0…(threshold on)	5 %

Adaptation of flow temperature



The adaptation of the flow temperature can be set as follows:

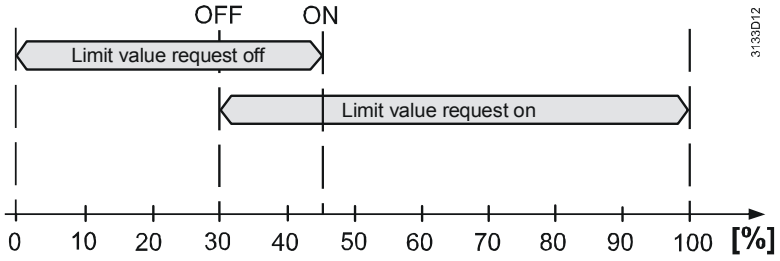
- The speed of flow temperature readjustment can be set under > Demand control > Control action
- The kind of evaluation of the consumers' valve positions can be selected under > Demand control > Request evaluation
  - When using the "Maximum" setting, the flow temperature is readjusted such that the valve position of the consumer with the greatest heat demand is 90%.
  - When using the "Average" setting, the flow temperature is readjusted such that the valve positions of the 4 largest consumers will be 90% on average.
    This setting does not ensure that the heat demand from all consumers can be satisfied. But it prevents an individual consumer from forcing the flow temperature to a high level (e.g. because a window was left open).

Note

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

Setting the limit value request

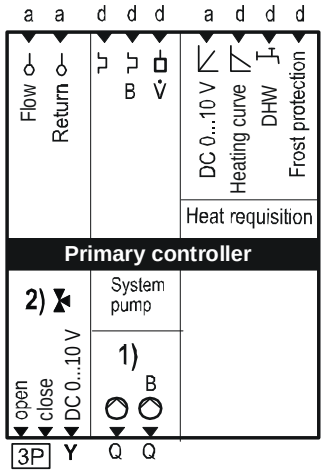
Both "On range" and "Off range" depend on the settings:

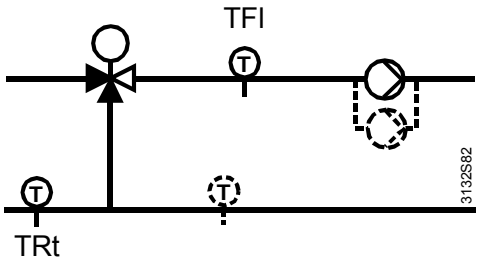


OFF…100 Setting range for limit value request On (e.g. OFF = 30%)
0…ON Setting range for limit value request Off (e.g. ON = 45%)

9 Precontrol

9.1 Overview of function block





Precontrol

TFI Flow temperature
TRt Return temperature

9.2 Configuration

Basic configuration

Function block “Primary controller“ must always be activated in the extra configuration.

Extra configuration

The function block is activated by assigning an output to a terminal.

Outputs

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

Operating line	*Adjustable values / remarks*
Mixing valve 3-pos	
Mixing valve modulating	
System pump	
System pump B	

Inputs

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

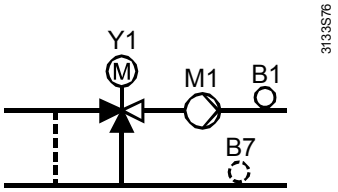
Operating line	*Adjustable values / remarks*
Flow sensor	
Return sensor	
[System pump] overload	
[System pump B] overload	
Flow signal pump	
Heat request modulating	
Heating curve request 2-pos	
DHW request 2-pos	
Frost prot request 2-pos	

Heat requests

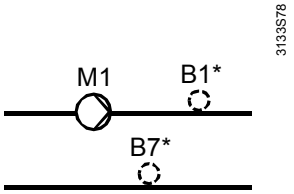
The heat requests can be received from other devices via bus. In addition, there are 3 binary inputs and 1 analog input for signalling heat requests.

9.3 Types of primary controller

If only a pump or twin pump is configured, the primary controller consists of system pump control. If, in addition, a mixing valve is configured, the primary controller consists of mixing circuit control plus pump or twin pump control.



Primary controller type 1:
With mixing valve



Primary controller type 2:
With system pump

B1 Flow temperature sensor (* = optional, for display only)
B7 Return temperature sensor (* = optional, for display only)
M1 System pump (can be a twin pump)
Y1 Mixing valve

Primary controller type 1 with mixing circuit can provide optional maximum limitation of the return temperature while primary controller type 2 only controls 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 defined whether a primary controller type 1 or type 2 is used. Without configuration of a mixing valve, type 2 is automatically used. It is also possible to define a flow temperature boost with the type 2 controller to compensate for temperature losses in the case of long pipes.

9.3.1 Control of mixing valve

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.

9.3.2 Pump control

Pump control offers a number of monitoring choices, no matter if it is a single or twin pump.
For more detailed information about pump control and twin pumps, refer to section 5.8 “Pump control”.

Fault setting primary 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
Fault acknowledgement B	None / Acknowledge / Acknowledge and reset	Acknowledge

9.4 Plant operation

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

Plant operation

■ Main menu > Primary controller > Plant operation

Operating line	*Range*	*Factory setting*
Preselection	Auto / Off*	Auto
State	Off / On	
Cause	Commissioning / Request / Frost protection for consumer / Frost protection for the flow / Frost protection for the plant / Overtemp protection / overrun / Plant operation selector / No request	

* Frost protection functions are ensured

Preselection (plant operation selector)

For service purposes, the primary controller can be switched off. In that case, the valve is closed and the pump switched off, or valve and pump start their overrun.
The heat demand is not passed on when in the “Off” position!

⇒ When preselecting “Off”, the internal frost protection function remains active and frost protection-related heat requests (frost protection for the flow) from externally is accepted and handled.

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

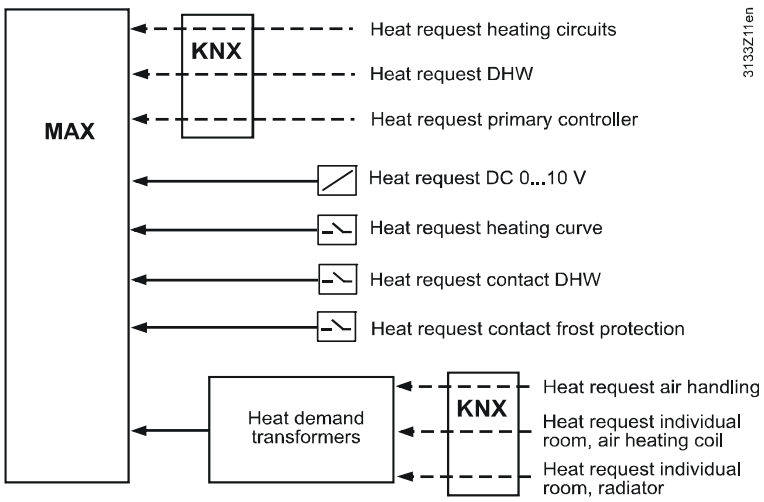
State

The display shows the primary controller’s current state (On / Off).

Cause

It is indicated why the current state is active.

9.5 Heat demand and heat request



Function block “Primary controller” collects the heat demand signals from all heat 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 signals to a flow temperature setpoint. In addition, 3 digital and/or 1 analog input can be configured on the controller as heat request inputs.

Extra configuration

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, the “Max” block (see illustration) generates the maximum value. This maximum value is the flow temperature setpoint for the primary controller. The setpoint is raised by the amount of the setpoint boost and send to a heat source or another primary controller as “Heat demand of precontrol”.

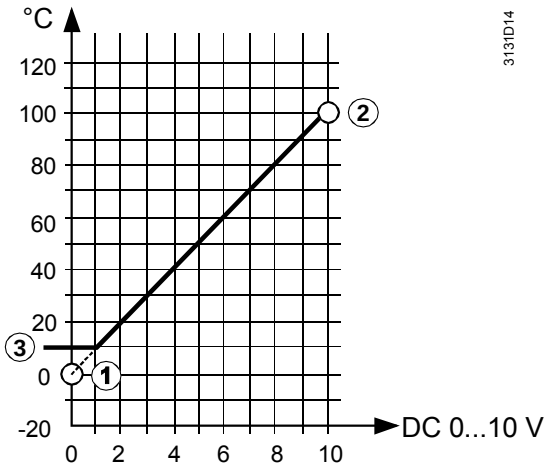
9.5.1 Heat request modulating

A heat request can be preselected with a DC 0…10 V signal.
The signal can be matched to the DC 0…10 V signal source.

Main menu > Commissioning > Settings > … or

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 °	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 below this level are interpreted as “no heat demand”)

Example:

The DC 0…10 V input signal shall correspond to a flow temperature setpoint range of 20…120 °C. The following parameter settings are required:
[Matching] setpoint at 0 V: 20 °C
[Matching] setpoint at 10 V: 120 °C

9.5.2 Heat request 2-position

Main menu > Commissioning > Settings > ... or

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

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Primary controller > Heat request

Operating line	*Range*	*Factory setting*
[2-pos] setpoint DHW	0…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 protection	0…140 °C	70 °C

Digital inputs

A total of 3 types of digital input are available. They are distinguished in the way they handle heat demand signals and in the different setting choices they offer.

- A signal received at input ”Heating curve request 2-pos“ is handled like a heat demand signal from one of the heating circuits. The setpoint is dependent on the outside temperature and determined via the same heating curve as demand control. For more detailed information about demand control, refer to section 8.3 “Heat demand transformers”.
- A signal received at input “DHW request 2-pos“ is handled like a signal from DHW heating. A constant setpoint can be preset. Also, the priority of the resulting DHW request can be selected. For more detailed information about DHW priority, refer to section 5.6.2 “Load control”.
- A signal received at input “Frost prot request 2-pos“ is handled like a heat request resulting from risk of frost. A constant setpoint can be preset

A heating curve request can be ignored in the summer while consideration is given to frost protection requests depending on the plant’s state.
Whether the input shall be active with the contact open or closed can be parameterized for each input.

Main menu > Commissioning > Settings > … or

Main menu > Settings > Inputs > RMK770... (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.

9.5.3 Heat demand transformers

For a description of the heat demand transformers, refer to section 8.3 “Heat demand transformers“.

9.6 Control of mixing valve

9.6.1 General

Load control

The thermal output of mixing valve control can be reduced by functions of a higher priority (e.g. limitation of the return temperature) or by functions of other plant (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 > Primary controller > 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
Locking signal gain	0…200%	100%
[Tn] return temp limitation max	0…60 min	30 min

Note

For more detailed information about mixing valve control and its settings, refer to chapter 5 “General functions, fundamentals”.
By using the locking signal gain, it is possible to predefine how intensely the primary controller shall respond to load control signals.

9.6.2 Load control

The primary controller can be influenced by load control signals of a heat source.

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

Load increase can be brought about in the form of pump or mixing valve overrun. In that case, it is only a maintenance of load.

9.7 Setpoint boost mixing valve and system pump

Typically, a mixing valve operates with a setpoint boost, enabling it to compensate for boiler temperature fluctuations.
With system pumps, this setpoint boost is not a basic requirement for compensating boiler temperature variations. However, in the case of long pipe distances between boiler and consumers, heat losses can occur, depending on the quality of pipe lagging, so that setpoint boost can be desirable in these situations also.

Main menu > Commissioning > Settings > … or
Main menu > Settings > Primary controller > Primary controller

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

9.8 Limit and protective functions

9.8.1 Frost protection

Frost protection for the plant

Here, the setting is made whether or not function “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”.

Function “Frost protection for the plant“ is only available if an outside sensor is installed (locally or connected via KNX bus). The function can be deactivated.

Frost protection for the flow

The minimum flow temperature is monitored. If the flow temperature falls below 5 °C, a heat demand signal is sent to the heat source and the mixing valve opens. The function will be ended as soon as the flow temperature has risen to 7 °C. The function will be active for a minimum of 5 minutes.

9.8.2 Limitations

Maximum limitation of the flow temperature

This setting provides maximum limitation of the flow temperature setpoint.

Minimum limitation of the flow temperature

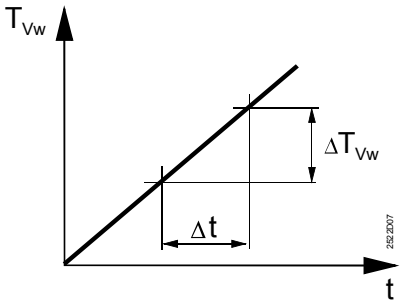
This setting provides minimum limitation of the flow temperature setpoint. Minimum limitation is only active when there is demand for heat.
Using setting --- (none), the function can be deactivated.

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 rate of increase of the flow temperature setpoint is the selected temperature per unit of time (K per hour).
Purpose of heating up brake:

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

Setting --- deactivates the function.



Maximum rise: = ΔT_{Vw} / Δt

t Time
Δt Unit of time
TVw Flow temperature setpoint
ΔTVw Rate of setpoint boost per unit of time

Return temperature limitations

Refer to subsection 9.8.3 “Limitation of the return temperature”.

System pump and locking signals

With setting “System pump locking signal“, it can be parameterized whether or not the system pump shall respond to critical locking signals.

Setting “System pump locking signal“	*Effect on locking signal*
Off	System pump is switched off
On	System pump remains switched on

Settings

Main menu > Commissioning > Settings > … or

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	Off

9.8.3 Limitation of the return temperature

Return sensor

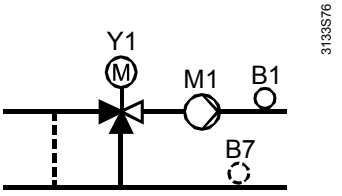
The primary controller provides maximum limitation of the return temperature depending on the number of consumers drawing heat. The following limitations are available:

- Maximum limitation during heating mode
- Maximum limitation during DHW heating

For both types of limitation, following applies:

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

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



Note

Minimum limitation of the return temperature is not supported.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Primary controller > Limitations

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…50 °C	–11 °C
[Curvepoint 1] return temp	---- / 0…140 °C	---- °C
[Curvepoint 2] outside temp	–50…50 °C	15 °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 flow temperature setpoint of the primary controller is lowered. When the return temperature returns to a level below the limit value, the reduction of the flow temperature setpoint is negated again. Limitation is provided in the form of I-control with an adjustable integral action time.

Main menu > Commissioning > Settings > ... or

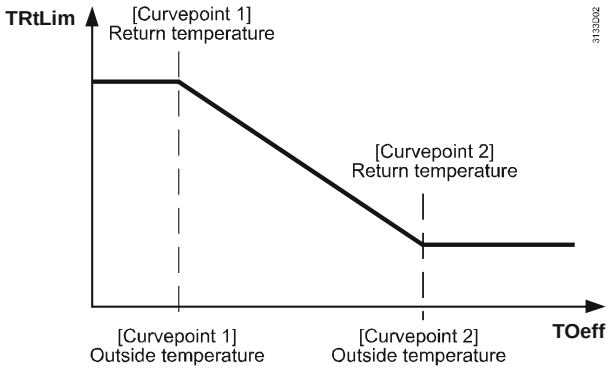
Main menu > Settings > Primary controller > Mixing circuit controller

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

Maximum limitation during heating mode

This limitation becomes active only when the respective primary controller needs to provide heat for heating or ventilation plant. It is deactivated as soon as DHW heating is switched on.

With this type of limitation, the level of return temperature limitation changes as a function of the outside temperature. The limitation is activated when a valid value is set for at least 1 maximum setpoint of the return temperature.



TrtLim Limit value of return temperature limitation
Toeff Composite (effectively acting) outside temperature
Curvepoint 1 Maximum limit value of the return temperature, effective at low outside temperatures
Curvepoint 2 Minimum limit value of the return temperature, effective at high outside temperatures

Special cases:

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

Maximum limitation during DHW heating

This limitation takes effect when the primary controller needs to provide heat for DHW. Maximum limitation in heating mode is deactivated.
Maximum limitation during DHW heating is constant, that is, independent of the outside temperature.
Limitation can be overridden by maximum limitation during DHW heating when the legionella function is active. For more detailed information, see below.
Again, this limitation is activated only when a valid value is set. If the value is invalid (entry of "----"), there is no limitation.

Maximum limitation during DHW heating when legionella function is active

This limitation takes effect when the legionella function of a DHW circuit connected to the primary controller is active. In that case, the maximum limitations during heating mode and DHW heating are deactivated.
Maximum limitation during DHW heating with the legionella function activated is constant, that is, independent of the outside temperature. Again, this limitation is activated only when a valid value is set. If the value is invalid (entry of "----"), there is no limitation.

9.8.4 Pulse limitation

The primary controller can accept pulses for limiting the output of heat or the volumetric flow. Prerequisite for pulse limitation is a primary controller plant with mixing valve.

Meter inputs

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

Settings

Main menu > Commissioning > Settings > ... or

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 “Meters“ that is used for pulse limitation. Only inputs configured to a terminal can be selected.

Type of limitation

There are 2 types of limitation:

- **Absolute:** Limitation becomes active when the limit value is crossed
- **Scaled:** The limit value is fixed at 75 pulses/min. It can be changed, but the change has no impact.
  If fewer than 5 pulses/min are received, fault status message ”No pulse signal meter 1” (or meter 2, 3 or 4) will be delivered after 20 seconds.

Limit value

From the limit value, pulse limitation starts throttling the actuating device (mixing valve). This setting takes effect only with absolute limitation. In the case of scaled limitation, the limit value can be changed, but the function works with 75 pulses/min (fixed value).

Integral action time Tn

The setting determines the rate at which the flow temperature is reduced:

- Short integral action times lead to faster reductions
- Long integral action times lead to slower reductions

9.8.5 Pump overrun and mixing valve overrun

To protect the boiler against overtemperatures after the burner has shut down (when there are no more heat consumers drawing heat), an overrun time for the consumers can be set on the boiler controller.
When the burner shuts down, the overrun time ensures that the heating circuits and DHW heating still draw heat for that period of time, provided they needed heat up to 1 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 runs; with primary controller type 2, only the pump runs during that period of time.

9.8.6 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.
For more detailed information, refer to section 5.5 “Pump kick and valve kick”.

9.9 Text designation

If desired, the primary controller can be assigned specific text. In that case, the selected text appears on the menu and the info display.

Primary controller

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Primary controller

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

9.10 Fault handling

Note

This section 9.10 shows the text for each fault number with which the controller is supplied. It can be changed on the password level.

Fault handling

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

Fault sensors

Number	*Text (as supplied)*	*Effect*
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 is driven to the fully closed position to become inactive (3-position actuator) enabling it to be manually operated.

Fault return temperature

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

The primary controller behaves as if no return temperature sensor was used. Limitation of the return temperature is inactive.

Fault heat request modulating

Number	*Text*	*Effect*
2203	Prim contr h'request mod error	Nonurgent message; must not be acknowledged

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

Fault primary controller or system pump

No.	*Text (as supplied)*	*Effect*
2501	[System pump] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: "Acknowledge"
2502	[System pump B] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: "Acknowledge"
2503	[System pump] no flow	Nonurgent message; must be acknowledged and reset
2504	[System pump B] no flow	Nonurgent message; must be acknowledged and reset
2505	[System pump B] fault	Urgent message, must not be acknowledged, plant stop

9.11 Diagnostic choices

■ 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 = request)
DHW request 2-pos	0 / 1 (1 = request)
Frost prot request 2-pos	0 / 1 (1 = request)
[System pump] overload	0 / 1 (1 = overload)

Operating line	*Range*
[System pump B] overload	0 / 1 (1 = overload)
Flow signal pump	0 / 1 (0 = no flow)
Optg hours pump	0…99999 h
Optg hours pump B	0…99999 h

When making diagnostics or the wiring test, logic states are displayed. The input is active when 1 appears on the display. If “Normal position open“ is selected, this is the case when the contact is closed; if “Normal position closed“ is selected, this is the case when the contact is open.

■ Main menu > Primary controller > Outputs

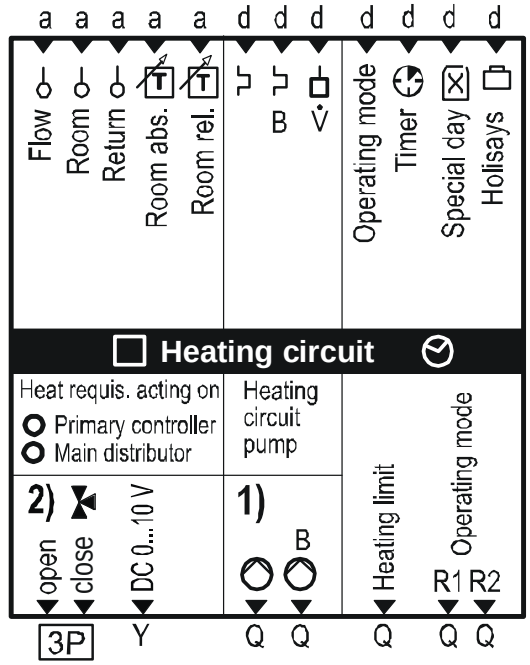
Operating line	*Range*
Mixing valve position	0…100%
System pump	Off / On
System pump B	Off / On

■ 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

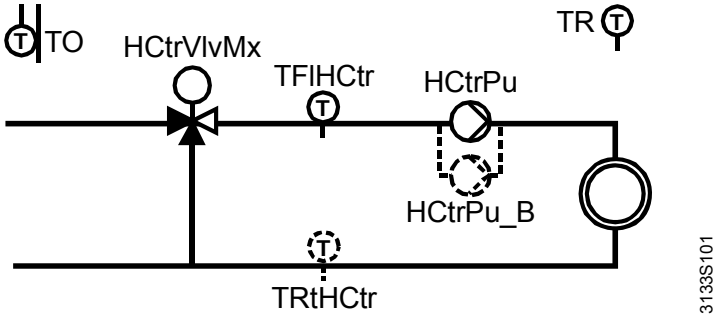
10 Heating circuit control

10.1 Overview of function block



Timer function
Special day input
Holidays 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

10.2 Configuration

Basic configuration

Function block “Heating circuit” must always be activated in the extra configuration.

Extra configuration

The function block is activated

- by assigning an output to a terminal, **or**
- by setting “Heating circuit = Active“

Main menu > Commissioning > Extra configuration > Heating circuit

Operating line	*Range*	*Factory setting*
Virtual heating circuit	Inactive / Active	Inactive

Virtual heating circuit

Using setting “Heating circuit = Active“, a virtual heating circuit can be activated, which predefines heat demand according to the outside temperature or the heating curve (for that purpose, a measured value of the outside temperature must be available), without having this measured value available for the flow sensor and the actuating devices.
A “real heating circuit” is activated by assigning the relevant inputs (flow temperature sensor) and outputs (heating circuit pump, mixing valve) to terminals.
For more detailed information about the virtual heating circuit, refer to section 8.2 “Weather-compensated setpoint for boiler sequencing”.

Outside sensor

A weather-compensated heating circuit necessitates an outside temperature. A sensor can be configured in Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs > Outside sensor.
The outside temperature can also be acquired via KNX bus. For more detailed information, refer to subsection 14.5.2 “Outside temperature”.

Inputs

Main menu > Commissioning > Extra configuration > Heating circuit > Inputs

Operating line	*Adjustable values / remarks*
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 ±3 K
[Heating circuit pump] overload	Fault input heating circuit pump
[Heat circuit pump B] overload	
Flow signal pump	Flow supervision heating circuit pump
Room operating mode	
Timer function	Comfort extension
Special day input	
Holiday input	

Outputs

Main menu > Commissioning > Extra configuration > Heating circuit > Outputs

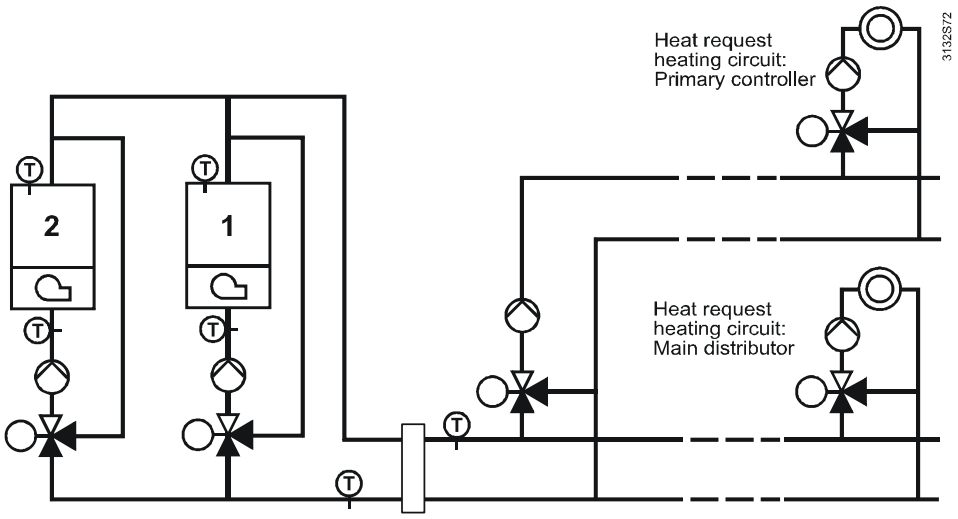
Operating line	*Adjustable values / remarks*
Mixing valve 3-pos	
Mixing valve modulating	
Heating circuit pump	
Heating circuit pump B	
Heating limit relay	
Operating mode relay 1	
Operating mode relay 2	

Heat request heating circuit

The internal heating circuit can be connected directly to the main header (heat distribution zone) or downstream from the primary controller (heat distribution zone on the consumption side provided a primary controller is present).
This can be parameterized by making the following setting:

Main menu > Commissioning > Extra configuration > Heating circuit > Heat req heat circ

Operating line	*Range*	*Factory setting*
Heat req heat circuit acting on	Main distributor / Primary controller	Main distributor



10.2.1 3-position or modulating mixing valve

Mixing valve control can be accomplished with a 3-position mixing valve or a mixing valve using DC 0…10 V control. The type of actuator is selected in the extra configuration.

Extra configuration

The output is activated via the extra configuration:

- Main menu > Commissioning > Extra configuration > Heating circuit > Outputs > Mixing valve 3-pos Assign terminal
- Main menu > Commissioning > Extra configuration > Heating circuit > Outputs > Mixing valve modulating Assign terminal

10.2.2 Pump control

The heating circuit pump offers the same choices as all the other pumps. The pump can be monitored as an individual pump; 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“.

10.3 Heating circuit operating mode

10.3.1 Room operating modes

Basics

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

Preselection	*Use*
Auto Auto	Factory setting. The room operating mode changes automatically according to the time program
Comfort	The room temperature is permanently maintained at the Comfort setpoint. This operating mode is selected when the room is constantly occupied
Precomfort	The room temperature is permanently maintained at the Precomfort setpoint. This operating mode is selected when room occupancy is probable

Preselection	*Use*
☾ Economy	This operating mode is suited when the room is not occupied for a few hours or when a reduced room temperature is desired. Economy mode is usually selected for the night
⓪ Protection	With this operating mode, the room is heated only when there is risk of frost, which could lead to frozen pipes, etc. The room temperature is maintained at a level above 0 °C.

The room temperature setpoint depends on the room operating mode. The flow temperature setpoint, the heating limit and the optimization functions are influenced by the current room temperature setpoint.

Room operating mode

■ Main menu > Heating circuit > Room operating mode

Operating line	*Range*	*Factory setting*
Preselection	🕒 Auto ☼ Comfort ☽ Precomfort ☾ Economy ⓪ Protection	🕒 Auto
State	☼ Comfort…⓪ Protection	
Cause	Time switch ⑫ Holidays⑩ or ⑪ Special day⑨ or ⑪ Timer function⑦ or ⑧ Room unit presence button⑥ Room operating mode selector⑤ Room operating mode contact④ External master③	

The control priorities ③…⑫ are explained in subsection 10.3.7 “Control priorities in the heating circuit”.

Preselection Room operating mode selector

Here, the plant operator can select the required operating mode. In operating mode 🕒 Auto , the setpoint is determined by the time switch or the plant operator. If required, it can be switched to continuous operation with a fixed setpoint.

⇒ In Protection mode, safety-related functions, such as frost protection, remain active.

State

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

Cause

There may be various reasons for the current state. Decisive is the control priority (refer to subsection 10.3.7 “Control priorities in the heating circuit”).

Time switch

In 🕒 Auto mode, the time switch switches the room operating mode or the setpoint according to the program entered. During the holiday period, the setpoint is predefined.

Holiday operating mode

■ Main menu > Heating circuit > Room operating mode

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

Note

The holiday function is only active in 🕒 Auto mode.

10.3.2 User requests from the room

Overriding the 24-hour program

The user is given a number of choices to override the current 24-hour program and to change the setpoint. Following can be used to override operation from the room:

- Switches or buttons (directly connected)
- KNX operator units (e.g. QAW740)
- Bus operator unit RMZ792

Room unit QAW740

The QAW740 room unit enables the user to select the room operating mode via the Mode or timer button.

Third-party devices with KNX interface

User interventions can also be made via third-party devices having a KNX interface (S-mode). Prerequisite is that the room operating mode is preset to Auto.

Presence button

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

Timer function

The timer function is identical with the timer function triggered via a conventional button. For this reason, the same setting is used for that period of time. For a description of this function, refer to subsection 10.3.4 “Timer function“.

Conventional switches and buttons

The inputs for the room operating mode and the timer function can be used to connect external switches or buttons for overriding the room operating mode. The next 2 sub-sections describe the manner of operation of these inputs.
The inputs override the other control interventions according to the control priorities.
A description of the control priorities is given in subsection 10.3.7 “Control priorities in the heating circuit“.

10.3.3 Room operating mode contact

Using a configurable input, a contact signal for changeover of the room operating mode can be acquired. Changeover takes place between the currently active operating mode and a selectable fixed operating mode.

Extra configuration

The input is activated via the extra configuration:

Main menu > Commissioning > Extra configuration > Heating circuit > Inputs > Room operating mode Assign terminal

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Space heating

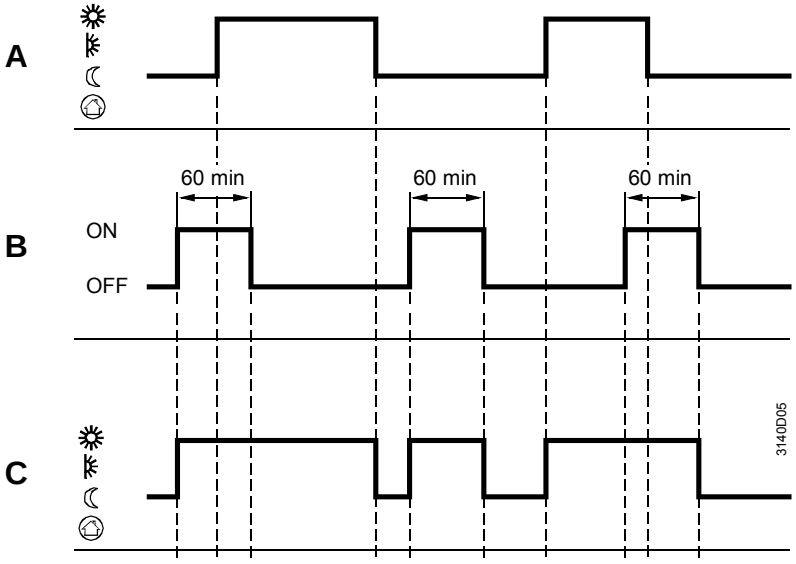
Operating line	*Range*	*Factory setting*
Preselected room optg mode	Comfort / Precomfort / Economy / Protection	Comfort
Heat limit with Comfort preset	Inactive / Active	Inactive

Heating limit with preset Comfort mode

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

10.3.4 Timer function

Using a configured input, the pulse triggered via a button can be acquired to extend Comfort mode when in Auto mode. The timer's time can be adjusted.
The timer function is immediately activated.



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

Extra configuration

The input is activated via the extra configuration:

Main menu > Commissioning > Extra configuration > Heating circuit > Inputs > Timer function
Assign terminal

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit > 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 this case, the setting is made directly on the room unit.

Tip

When activated, the timer can be stopped by changing the room operating mode (e.g. via the room operating mode selector).

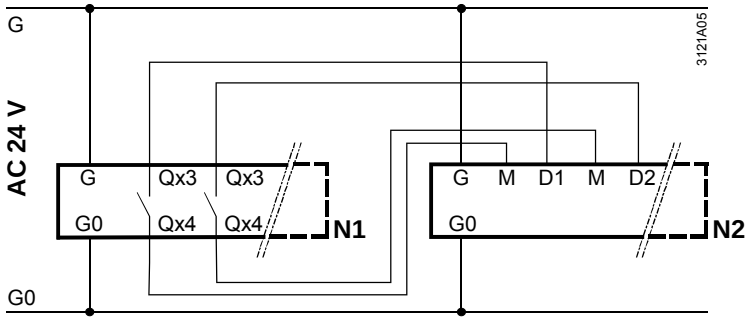
10.3.5 Room operating mode outputs

Purpose

Function block outputs "Operating mode R1" and "Operating mode R2" enable the resultant room operating mode of a heating circuit to be sent to 1 or 2 relays. This is always possible; it is of no importance whether or not heating circuit control is used.

Application example

Forwarding the resultant room operating mode from relay outputs Qx of the RMK770 controller to a Synco™200 controller:



N1 RMK770
N2 Synco™200 RLU2…

Configuration of the 2 operating mode relays

Main menu > Commissioning > Extra configuration > Heating circuit > Outputs

Operating line	*Adjustable values / display / remarks*
Operating mode relay 1	--- / N.Q1…, etc. (free relays only) / Assign operating mode relay
Operating mode relay 2	--- / N.Q1…, etc. (free relays only) / Assign operating mode relay

Settings

The Settings menu can be used to define for each room operating mode the operating mode relay to be energized.

Main menu > Settings > Heating circuit > 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 is 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 Precomfort mode, Precomfort is switched to Comfort. This setting can be matched to individual requirements.

Meaning of selectable values

The selectable values for the operating mode relays listed above under ”Settings” have the following meaning:

Selected value	*State of relay R1*	*State of relay R2*
---	Deenergized	Deenergized
R1	Energized	Deenergized
R2	Deenergized	Energized
R1+R2	Energized	Energized

Display values

The Outputs menu shows the states of the operating mode relays:

Main menu > Heating circuits > Outputs

Operating line	*Current state*
Operating mode relay 1	Deenergized or energized
Operating mode relay 2	Deenergized or energized

10.3.6 Plant operation

Plant operation indicates whether the heating circuit is switched on and whether the pump operates.

Plant operation

Main menu > Heating circuit > 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 / Overtemp protection / Overrun / Plant operating mode selector / No request / Frost protection for the flow / Frost protection for the plant	

* Frost protection functions ensured

Preselection

For service purposes, the heating circuit can be shut down. In that case, the mixing valve is driven to the fully closed position and the heating circuit pump is deactivated on completion of the overrun time. When preselecting “Off“, the internal frost protection function remains active.

⚠ When service work is completed, the selector must be reset to Auto mode.

State

The heating circuit’s current state is displayed (On or Off).

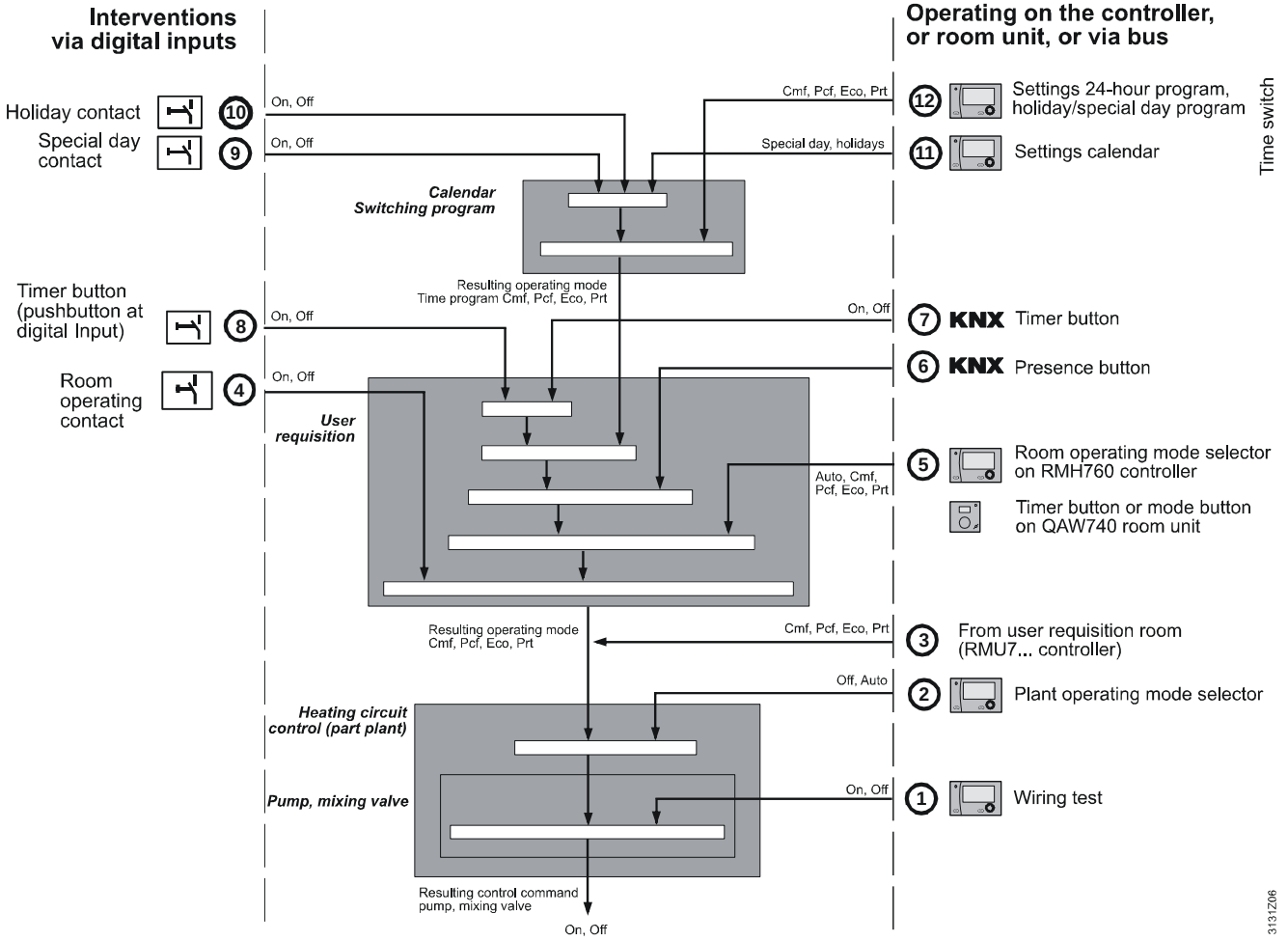
Cause

The reason for the current heating circuit state is displayed.

10.3.7 Control priorities in the heating circuit

The following illustration shows the priorities of the different choices of intervention via digital inputs or the KNX bus as well as operation on the controller or on 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	Plant operation selector	The plant operating mode selector has the second highest priority and can only be overridden by the controller's frost protection
③	External master	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 optg mode contact	Using the room operating mode contact, a fixed operating mode can be preselected. This operating mode overrides the room operating mode selector ⑤ on the controller
⑤	Room optg mode selector	The room operating mode selector can be used to switch from Auto mode to a continuous operating mode with an appropriate setpoint. In Auto mode, the setpoint is determined by the time switch or the presence button and timer function

Priority	*Name*	*Explanation*
⑥ ⑦ / ⑧	Presence 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 third-party KNX device) can also override the room operating mode. If 2 or more functions are triggered, the function activated last prevails.
⑨	Special day contact	The current 24-hour program gets overridden by the special day contact. The special day program is activated in the time switch
⑩	Holidays contact	The current 7-day program is overridden by the holidays 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 is activated. Holidays, if entered, are overridden. If holiday mode is active, the selected room operating mode is used
⑫	Time switch	In the time switch, the associated 24-hour program is activated in accordance with the current week-day. The 24-hour program forwards the current room operating mode, the next setpoint, and the time up to the next switching point

10.4 Room temperature setpoints

10.4.1 Settings

The setpoints for the 4 room operating modes can be preselected by the plant operator via operation. The setting values limit one another.

Main menu > Heating circuit > Room setpoints

Main menu > Settings > Heating circuit > 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 of 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, refer to the 2 subsections below.
The 4 setpoints are readjusted according to the following rules:

- Parallel readjustment of Comfort and Precomfort setpoint
- When the Economy setpoint is reached, it is shifted along with the Precomfort setpoint
- With the Protection setpoint, the Comfort, Precomfort and Economy setpoints are limited

Display of inputs/setpoints

The effective setpoint is displayed on the service level and on the Info page.

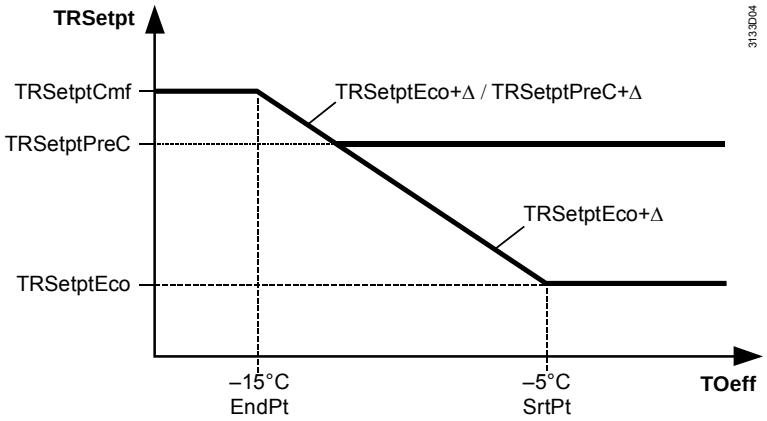
Main menu > Heating circuit > Inputs/setpoints

Operating line	*Range*	*Factory setting*
Current room temp setpoint	…°C	
Room setpoint absolute*	…°C	
Room setpoint relative*	…°C	

* Only if configured via extra configuration

10.4.2 Increasing the Economy setpoint

The room temperature setpoint of Economy mode is increased depending on the composite outside temperature. The increase is greater at low outside temperatures and zero at high outside temperatures; the transitions are adjustable.
The function helps prevent peak loads when changing from Economy to Precomfort or Comfort mode.



EndPt	End point of increase (here –15 °C)
SrtPt	Start point of increase (here –5 °C)
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 > Optimizations/influences

Operating line	*Range*	*Factory setting*
Economy increase start point	–15…50 °C	–5 °C
Economy increase end point	–50…–5 °C	–15 °C

Display values

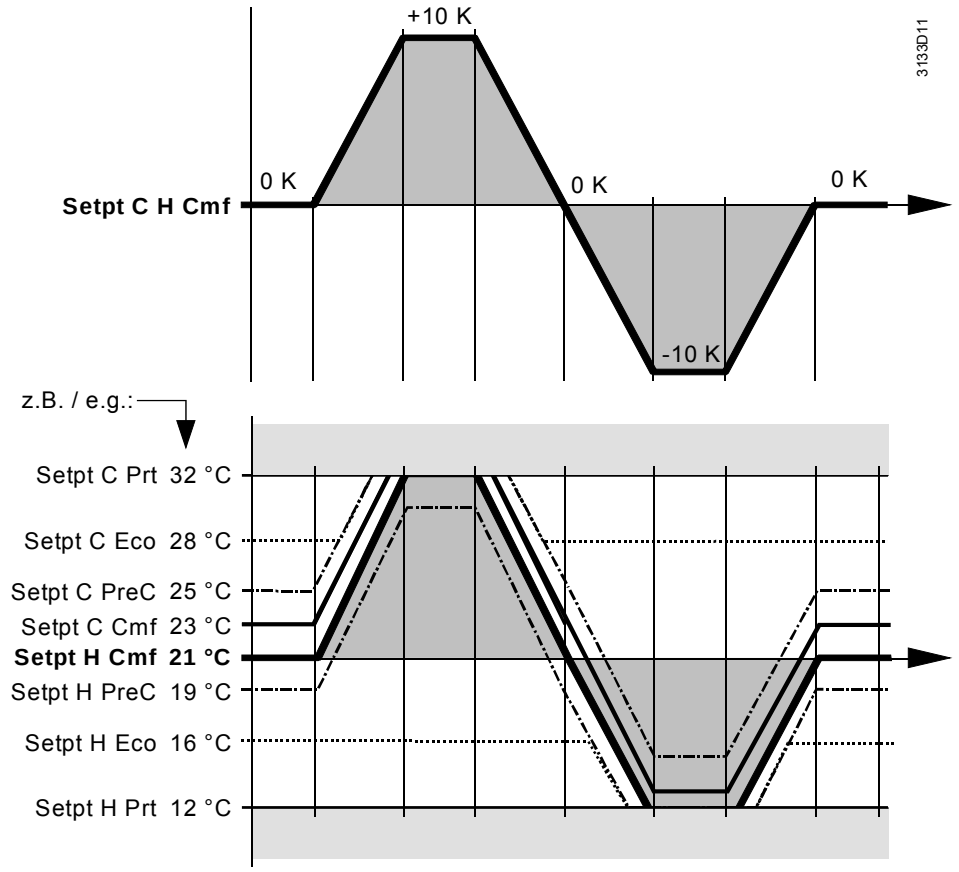
The Inputs/setpoints menu shows the extent of Economy setpoint increase:

Main menu > Heating circuit > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Economy increase	Inactive / Active

10.4.3 Room temperature setpoint adjuster, absolute

For preselection of the room temperature setpoints for Comfort and Precomfort mode, a remote setpoint adjuster (e.g. BSG21.1) can be configured.
The 4 setpoints can be readjusted as shown in the following illustration.
The upper curve shows the difference between the remote setpoint adjuster's setpoint and the selected Comfort setpoint. This difference affects the other setpoints in different ways. This is shown by the curves in the lower part of the diagram.



C	Cooling
Cmf	Comfort
Eco	Economy
H	Heating
PreC	Precomfort
Prt	Protection
Setpt	Setpoint

Impact on the Comfort setpoint

The current Comfort setpoint ☼ is the setpoint selected with the remote setpoint adjuster.
Although the remote setpoint adjuster predefines the Comfort setpoint, a fixed Comfort setpoint ”Heating” must be entered via Main menu > Heating circuit > Room setpoints. From the difference between the fixed Comfort setpoint for “Heating“ and the setting made with the remote setpoint adjuster, the current Comfort setpoint for ”Cooling“ can be calculated:

Comfort setpoint “Cooling“ + (“Remote setpoint” minus Comfort setpoint “Heating“)

Note

The RMK770 controller has no Comfort setpoint for “Cooling“. The impact on the Comfort setpoint for “Cooling“ as described above is only possible in connection with a room control combination. For more detailed information, refer to subsection 10.10.3 “Room control combination“.
The setpoint shifts are limited by the setpoints for Protection (also refer to the diagram above).

Impact on the Precomfort setpoint

The Precomfort setpoints ☽ are shifted also:
Hence, the current Precomfort setpoint for “Heating“ is calculated as follows:

Precomfort setpoint “Heating“ + (“Remote setpoint“ minus Comfort setpoint “Heating“)

And the current Precomfort setpoint for “Cooling“:

Precomfort setpoint “Cooling“ + (“Remote setpoint“ minus Comfort setpoint “Heating“)

The information given in paragraph ”Impact on the Comfort setpoint“ 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 diagram above).

Extra configuration

The input is activated via the extra configuration:

Main menu > Commissioning > Extra configuration > Heating circuit > Inputs > Room setpoint adjuster absolute 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.

Notes

- We do not recommend 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
- It is **not** possible to connect a DC 0…10 V setpoint adjuster. The input is preconfigured exclusively for 0…1000 Ω
- The adjusted setpoint represents the Comfort setpoint. The Precomfort setpoint is shifted parallel so that the difference between the 2 setpoints is maintained

10.4.4 Room temperature setpoint adjuster, relative

For the room temperature setpoint readjustment 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 activated via the extra configuration:

Main menu > Commissioning > Extra configuration > Heating circuit > Inputs > Room setpoint adjuster relative Assign terminal

Settings

There are no settings required.

10.5 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 compensating variable of heating circuit control is the outside temperature. It can be acquired via different sources:

- By the locally connected outside sensor
- Via bus from some other device

The controller provides a common outside temperature for all applications. This means that outside temperature-dependent functions of the same controller operate with the same outside temperature as the compensating variable.

Composite outside temperature

Depending on the type of building construction, the outside temperature's impact on the room is delayed. For this reason, the compensating 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 required (refer to section below).

Heating curve

The heating curve is defined by the 2 curvepoints at the design temperature and the theoretical heating limit. Heat transmission in the space is not linear, however. When the difference between flow temperature and room temperature is small, the rate of heat transmission diminishes. This is considered by the heating curve.

Other influences

The setpoint predefined by the heating curve can additionally be influenced by the following factors:

- Room temperature setpoint
- Current room temperature (room temperature influence)

10.5.1 The composite and the attenuated outside temperature

Identifiers used:

To	Outside temperature
Toeff	Outside temperature
Tofil	Outside temperature filtered with the building time constant
ToStrDmp	Outside temperature
τBldg	Building time constant
p_{Window}	Proportion of windows in %

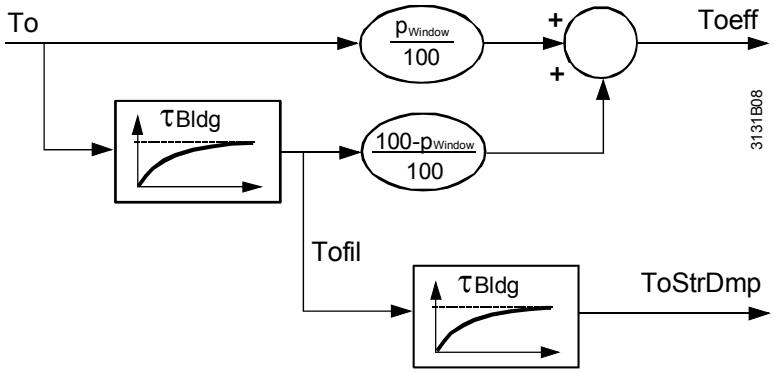
Composite outside temperature

The composite outside temperature is made up of the current outside temperature To and the outside temperature Tofil filtered with the building time constant τBldg. The proportion of windows p_{Window} (adjustable from 0 to 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.

Outside temperature

To obtain the attenuated outside temperature, the actual outside temperature To is filtered twice with the building time constant τBldg.

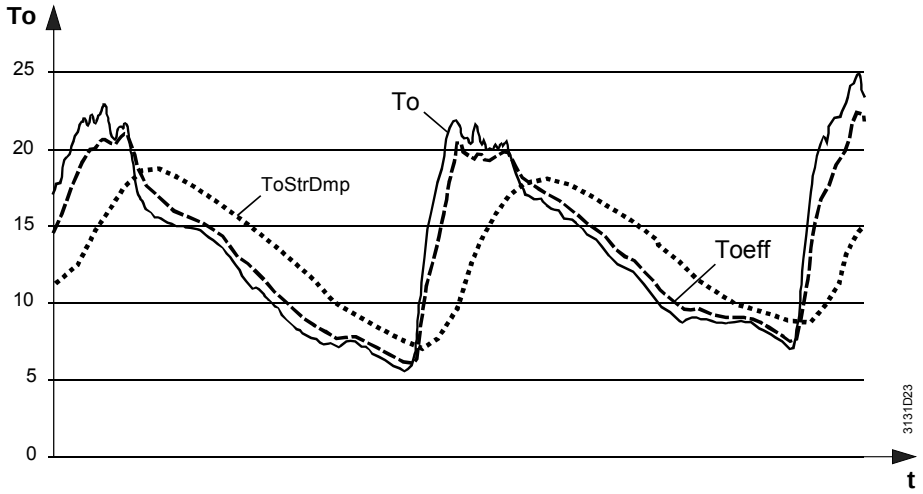


⇒ For the heating limit, the actual, the composite and the attenuated outside temperature are considered.

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 actual and 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 > Space heating

Operating line	*Range*	*Factory setting*
Building time constant	0…100 h	20 h

Heating curve

Main menu > Settings > Heating circuit > Heating curve or
Main menu > Heating circuit > Heating curve

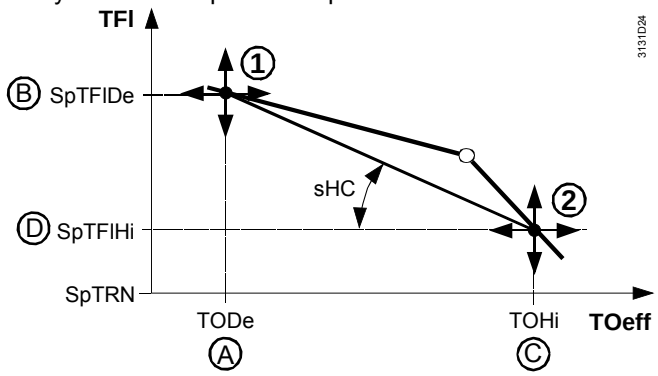
Operating line	*Range*	*Factory setting*
Proportion of windows	0…100%	50%

10.5.2 Heating curve

Curvepoints

The heating curve is defined by 2 curvepoints:
①: At the design temperature:
- By the outside temperature ToDe Ⓐ
- By the flow temperature SpTFlDe Ⓑ

②: At the theoretical heating limit:
- By the outside temperature ToHi Ⓒ
- By the flow temperature SpTFlHi Ⓓ



Radiator exponent

The nonlinear heat transmission is considered by the radiator exponent nH. The following table gives an overview of the 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

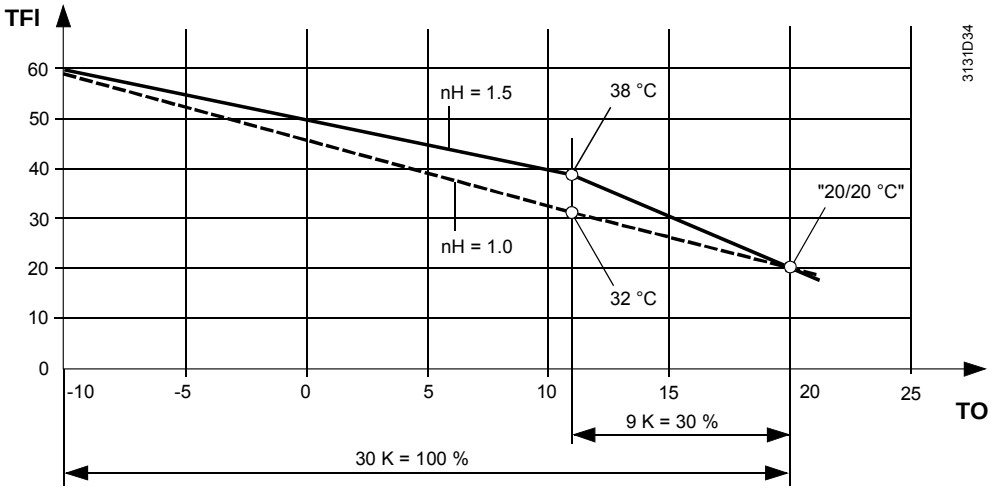
With a radiator exponent *nH* between 1…1.5, the heating curve is only slightly deflected and can therefore be replaced by linearized sections. This is achieved by setting another curvepoint, the so-called inflection point.
The inflection point lies 30% below the outside temperature at which the flow 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. If the setpoint is lower or higher, the heating curve is appropriately shifted (refer to subsection 10.5.3 “Influence on the flow temperature setpoint”).

Example

Outside temperature at the 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 inflection point is dependent on the flow temperature setpoint and on 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:

$$\text{Lift} \approx (32\ °C - 20\ °C) \times (1.5 - 1) = 6\ K$$

Settings

Main menu > Heating circuit > Heating curve

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…10 °C	–11 °C
[Curvepoint 1] flow temp	30…130 °C	60 °C
[Curvepoint 2] outside temp	5…30 °C	15 °C
[Curvepoint 2] flow temp	30…130 °C	30 °C
Radiator exponent	1.00…1.50	1.30

Main menu > Settings > Heating circuit > Heating curve

Operating line	*Range*	*Factory setting*
Radiator exponent	1.00…2.00	1.30

Notes

The heating curve is identical to that of DESIGO.
Setting of the radiator exponent can be derived from the type of heating system and is based on physical ground.

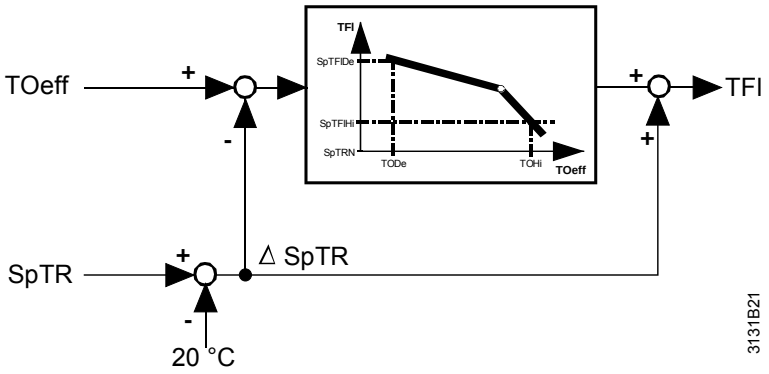
10.5.3 Influence on the flow temperature setpoint

Basis for the flow temperature setpoint is the heating curve. In addition, the setpoint is influenced by the following variables:

- Room setpoints
- Actual value of the room temperature
- Morning boost (refer to subsection 10.7.3 “Quick setback and boost heating”)

Influence 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 heating curve displacement by the same amount toward the outside temperature and 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 = ?

$$sHc = \frac{60 - 30}{(15 - [-5])} = 1.5 \quad \Rightarrow \quad \Delta TFl = 2\ K \times (1.5 + 1) = 5\ K$$

Influence of the room temperature

A deviation of the room temperature from the room temperature setpoint has an impact on the flow temperature setpoint only if room influence is activated.

⇒ Connection of a room temperature sensor does not automatically activate the room influence.

An LG-Ni1000 sensor can be connected as a room temperature sensor (extra configuration), or a room unit transmits the room temperature via bus.

⚠

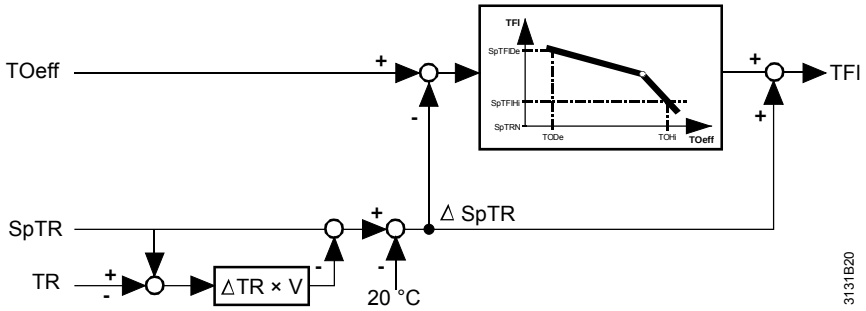
In plants where the heating circuit operates in connection with a ventilation system as a room control combination, the room temperature sensor of the ventilation system must not be located in the extract air!

The set room 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 > Optimizations/influences

Operating line	*Range*	*Factory setting*
Room influence	---- (none) / 0…10	----



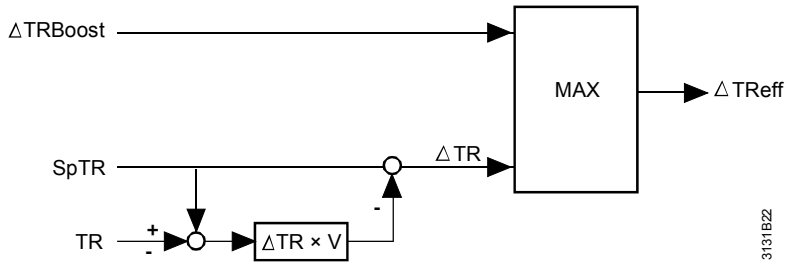
Rule of thumb

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	Flow temperature setpoint change	sHc	Heating curve slope
ΔTR	Room temperature setpoint change	Sp	Setpoint
V	Room influence	TRx	Room temperature

During boost heating, the room temperature setpoint boost 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 resultant room temperature setpoint has a minimum limitation at 5 °C and a maximum limitation at 35 °C.

10.5.4 Heating limit switch

The heating limit switch can restrict the amount of heat delivered 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 10.5.1 “The composite and the attenuated outside temperature”):

- The current outside temperature TO
- The composite outside temperature Toeff
- The attenuated outside temperature TostrDmp

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit > 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

Note the following:

- When the Comfort heating limit is set to “----“ (no heating limit), a heating limit only applies to Economy and Protection mode. And there is no changeover to summer operation
- When the Economy heating limit is set to “----“ (no heating limit), the Comfort heating limit takes effect in Economy and Protection mode

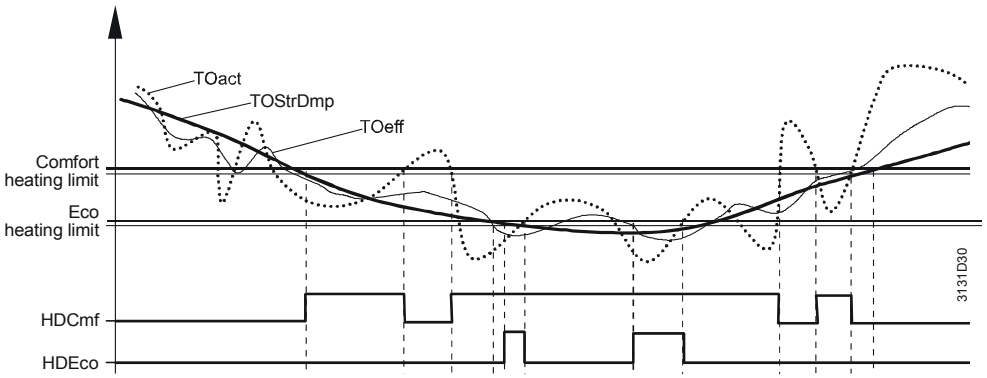
Comfort heating limit

- When **all 3** temperatures lie 1 °C **below** the Comfort heating limit, heat is released in Comfort ☼ and Precomfort ☼ mode
- When **1 of the 3** temperatures lies **above** the Comfort heating limit, the delivery of heat is locked

⇒ If a change was made to “Continuously Comfort”, the heating limit function is inactive, which means that continuous heating is provided in accordance with the heating curve. Exempted from this is the room control combination with an RMU7xxB controller.

Economy heating limit

- When **all 3** temperatures lie 1 °C **below** the Economy heating limit, heat is released in Economy ☾ and Protection ⓐ mode
- When **1 of the 3** temperatures lies **above** the Economy heating limit, delivery of heat is locked



Heating limit with preset Comfort mode

Whether or not the heating limit function shall be active in “Continuously Comfort ☼“ mode can be selected on the Space heating menu.
This selection is always active, irrespective of whether the operating mode was selected via the operator unit or the room unit, or whether – on the basis of the room operating mode contact – it was switched to ”Continuously Comfort ☼“. Exempted from this is the room control combination with an RMU7xxB ventilation controller, in which case the heating limit always takes effect.

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 is made; this also applies to “Continuously Comfort ☼”.

10.6 Mixing valve control

10.6.1 Control

Setpoint

The flow temperature setpoint determined by weather-compensated heating circuit control produces the effective setpoint for mixing valve control while giving consideration to load control.

3-position / DC 0…10 V actuator

Mixing valve control can be accomplished with a 3-position mixing valve or a mixing valve using DC 0…10 V control. The type of actuator is selected in the extra configuration.
The following mixing valve settings apply to both the 3-position mixing valve and the DC 0…10 V actuator:

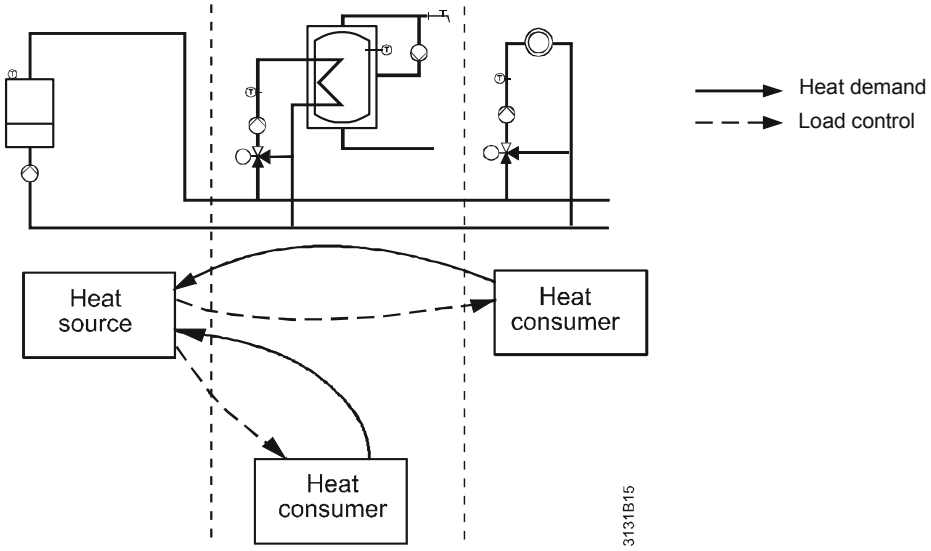
Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Mixing circuit controller

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”.

10.6.2 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 plant (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

A load increase can be in the form of pump and/or mixing valve overrun. In principle, this merely means maintaining the load.

10.7 Optimization functions

The optimization functions are activated or influenced by the following settings:

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > 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	6 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

10.7.1 Type of optimization

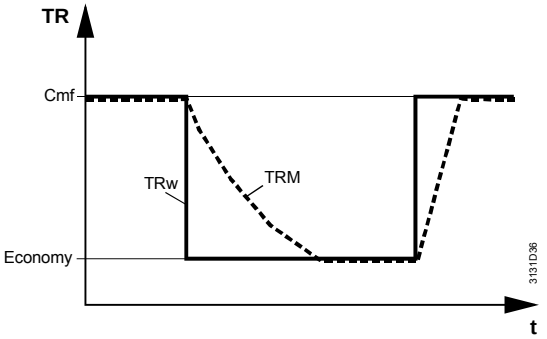
The type of optimization decides whether the optimization functions and boost heating shall be performed based on the acquired room temperature or whether the room model shall be used.

Caution

In plant where the heating circuit operates in connection with a ventilation system as a room control combination, the room temperature sensor of the ventilation plant must **not** be located in the extract air!

Room model

Based on the outside temperature, the building time constant and the rate of room temperature increase, the room model calculates the room temperature.
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 increases of the room temperature setpoint, the room model temperature is updated at the rate of room temperature increase. In the case of sudden negative drops, the room model temperature approaches the composite outside temperature at 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 > Optimizations/influences

Operating line	*Range*	*Factory setting*
Type of optimization	With room model / With room temp sensor	With room model

10.7.2 Optimum start / 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, the heating circuit must be switched on at an earlier point in time.
If a room temperature sensor is connected, the controller calculates the forward shift depending on the current room temperature. Also, the controller learns the necessary heating up time per K room temperature.
When the required room temperature is reached, the time differential to the entered time is determined. Based on the deviation ascertained, the controller can readjust the heating up time per K room temperature and calculate the next forward shift with this 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 (duration in min/K) can be set.
The maximum forward shift can also be set. When entering 0 hours as the maximum heating up time, optimum start control is deactivated.

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Optimizations/influences

Operating line	*Range*	*Factory setting*
Forward shift on max	0…48 h	6 h
Room temperature rise	1…600 min/K	60 min/K

Optimum stop control

Optimum stop control switches the heating circuit off at the earliest possible point in time so that – when the time switch changes from Comfort ☼ or Precomfort ☼ to Economy ☼ or Protection ☼ mode – the room temperature will lie 0.5 K below the Comfort or Precomfort setpoint.

⇒ Optimum stop control is only possible if the type of optimization selected is “with room temperature sensor”.

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Optimizations/influences

Operating line	*Range*	*Factory setting*
Early shutdown max	00.00…06:00 h.min	00:00 h.min

Early shutdown max

Early shutdown max limits the maximum forward shift. If 00:00 is set, optimum stop control is deactivated.

10.7.3 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.
When quick setback is active, the heating circuit pump is switched off and the heating circuit mixing valve shut. The heating circuit remains switched 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 > Optimizations/influences

Operating line	*Range*	*Factory setting*
Quick setback	Off / On	On

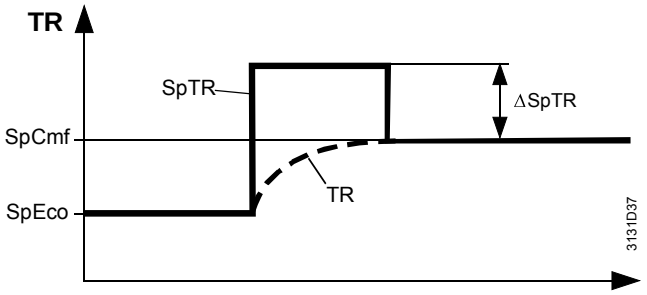
Quick setback is started when the room operating mode changes **from** Comfort ☼ or Precomfort ☼ **to** Economy ☾ or Protection ⊛. The function is ended when the room temperature has reached the new setpoint or when a change back to Comfort ☼ mode is made.

Room temperature

If a room temperature sensor is connected, the actual value room temperature is 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 depends on the outside temperature and the building time constant.

Morning boost

The purpose of the “Boost heating” function is to have a shorter heating up time.
During boost heating, the room temperature setpoint is raised by an adjustable value.
The room temperature setpoint boost due to the morning boost and the room influence bring about an increase of the flow temperature setpoint. The larger of the 2 influences is active.
Morning boost is activated when a change is made from Economy mode ☾ or Protection ⏻ to Comfort ☼ or Precomfort mode ⊱ **and** when the room temperature lies at least 0.25 K below the setpoint.



TR Room temperature
SP Setpoint
SpCmf Setpoint, room operating mode Comfort **or** Precomfort
SpEco Setpoint, room operating mode Economy **or** Protection

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Optimizations/influences

Operating line	*Range*	*Factory setting*
[Boost heating] setpoint increase	--- / 0…20 K	5 K

10.8 Limit and protective functions

10.8.1 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 influence with modulating action on the flow temperature setpoint, maximum limitation of the room temperature uses 2-position control.

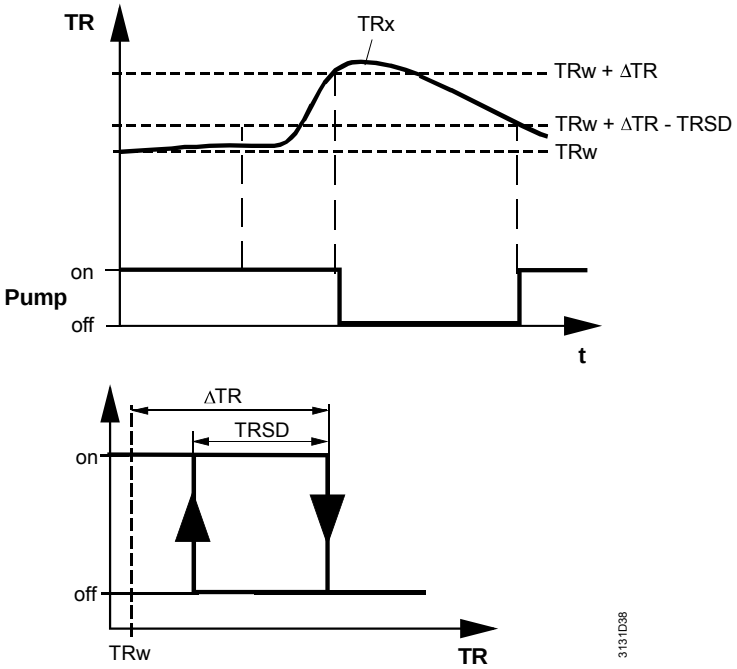
Deactivation

When the actual value room temperature has exceeded the room temperature setpoint by the adjustable room limitation increase, the heating circuit pump is deactivated.

⇒ When the pump is switched off, the heating circuit does not call for heat.

Activation

When the room temperature falls below the switch-off point by the amount of the room switching differential, the heating circuit pump is switched on.



t Temperature differential for switching the heating circuit off
ΔTR Time
TR Room temperature
TRSD Temperature differential for switching the heating circuit on
TRw Room temperature setpoint
TRx Actual room temperature

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Limitations

Operating line	*Range*	*Factory setting*
Room limitation increase	---- (none) / 0.5…5.0 K	----
Room lim switching differential	0.2…5.0 K	0.5 K

Room limitation increase

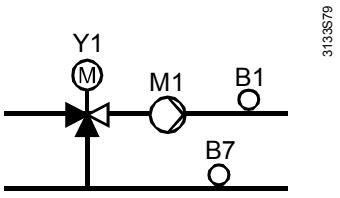
The room limitation increase is used to set the temperature differential for switching the heating circuit off.

Room lim switching differential

The room switching differential is used to set the temperature differential for switching on the heating circuit.

10.8.2 Return temperature limitation

The heating circuit's mixing valve can be used to ensure maximum limitation of the return temperature. Minimum limitation is not supported.



B1 Flow sensor
B7 Return sensor
M1 Heating circuit pump
Y1 Heating circuit mixing valve

Extra configuration

The function is activated via the extra configuration:
... > Heating circuit > Inputs > Return sensor Assign terminal

Settings

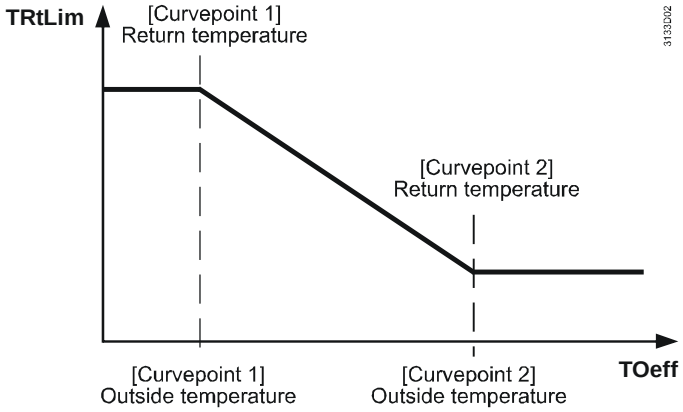
Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit > Limitations

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…50 °C	–11 °C
[Curvepoint 1] return temp	---- / 0…140 °C	----°C
[Curvepoint 2] outside temp	–50…50 °C	15 °C
[Curvepoint 2] return temp	---- / 0…140 °C	----°C

Maximum limitation

The maximum limit value of the return temperature is either constant or changes depending on the outside temperature. Limitation is activated if the setting of at least 1 maximum return temperature setpoint is valid.



TrtLim Limit value of return temperature limitation
Toeff Composite (effectively acting) outside temperature
Curvepoint 1 Maximum return temperature limit value (effective at low outside temperatures)
Curvepoint 2 Minimum return temperature limit value (effective at high outside temperatures

Special cases

Setting	*Effect*
[Curvepoint 1] return temp = [Curvepoint 2] return temp	Constant return temperature limitation. The outside temperature is irrelevant
[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 setpoint of the return temperature. The outside temperature is irrelevant
[Curvepoint 2] return temp = ---	Constant return temperature limitation with [Curvepoint 1] maximum setpoint of the return temperature. The outside temperature is irrelevant
[Curvepoint 1] return temp and [Curvepoint 2] return temp = ---	Return temperature limitation is deactivated

If the return temperature exceeds the limit value, the flow temperature setpoint of the primary controller is reduced. When the return temperature returns to a level below the limit value, reduction of the flow temperature setpoint is decreased again.
Limitation is provided in the form of an I-controller; the integral action time is adjustable.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit > Mixing circuit controller

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

10.8.3 Pulse limitation

The heating circuit can accept pulses for limiting the output of heat or the volumetric flow. Prerequisite for pulse limitation is a heating circuit plant with mixing valve.

Meter inputs

The pulses are delivered via the meter inputs of function block “Meters”. For more detailed information about function block “Meters”, refer to chapter 11 “Data acquisition“. After having configured one or several meter inputs, pulse limitation can be set up.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit > 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 “Meters” used for pulse limitation. Only inputs configured to a terminal can be selected.

Type of limitation

There are 2 types of limitation to choose from:

- Absolute: Limitation becomes active when the limit value is exceeded
- Scaled: The limit value is fixed at 75 pulses/min. It can be changed, but the change has no impact.
  If fewer than 5 pulses/min are received, fault status message ”No pulse signal meter 1” (or meter 2 , etc.) will be delivered after 20 seconds.

Limit value

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

Integral action time Tn

The setting value determines the rate of flow temperature reduction:

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

10.8.4 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 opens. The function is ended as soon as the flow temperature has returned to a level of 7 °C. The function is active for a minimum of 5 minutes.

Flow temperature maximum limitation

This setting ensures maximum limitation of the flow temperature setpoint.

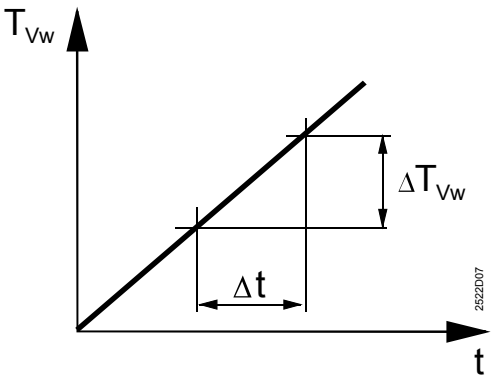
Flow temperature minimum limitation

This setting provides minimum limitation of the flow temperature setpoint. Minimum limitation is only active when there is demand for heat.
Setting --- (none) deactivates the function.

Heating up brake

The rate of flow temperature increase can be limited to a maximum (heating up brake). In that case, the maximum rate of flow temperature setpoint increase is the set 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 boost = $\Delta T_{Vw} / \Delta t$

t Time
Δt Unit of time
TVw Flow temperature setpoint
ΔTVw Rate of setpoint boost per unit of time

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Limitations

Operating line	*Range*	*Factory setting*
Flow temp rise max	---- (none) / 1…600 K/h	----
Flow temperature max	0…140 °C	80 °C
Flow temperature min	---- (none) / 0…140 °C	----
Frost protection for the plant	Off / On	On

10.8.5 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.

10.8.6 Pump kick and valve kick

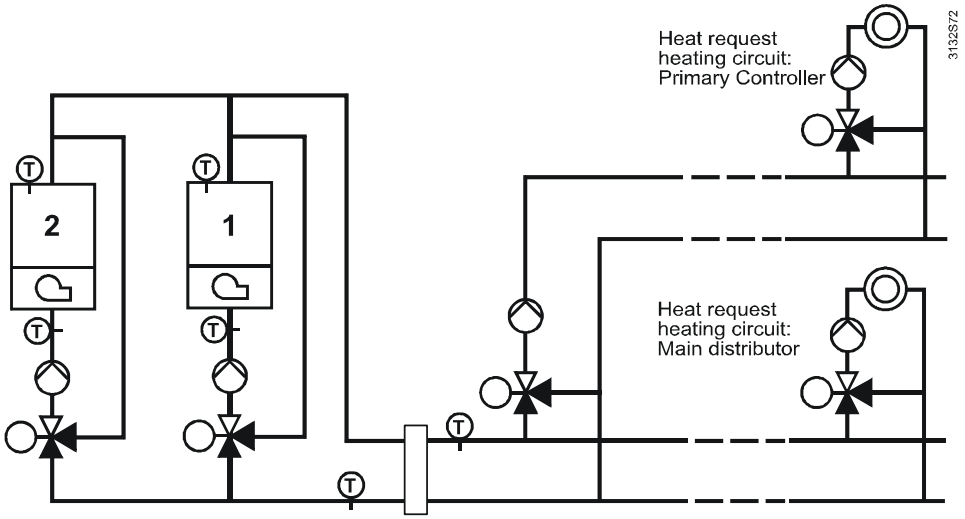
The pump kick is a protective function that is carried out periodically. It prevents pumps and/or mixing valves from seizing after longer off periods.

10.9 Heat demand

The internal heating circuit can be connected either directly to the main header (heat distribution zone) or downstream from the primary controller (heat distribution zone on the consumer side if a primary controller is present).
This can be parameterized with the following setting:

Main menu > Commissioning > Extra configuration > Heating circuit > Heat req heat circ

Operating line	*Range*	*Factory setting*
Heat req heat circuit acting on	Main distributor / Primary controller	Main distributor



The temperature request for the current heat demand is calculated based on the flow temperature setpoint of the heating circuit (refer to subsections 10.5.2 “Heating curve” and 10.5.3 “Influence on the flow temperature setpoint”) plus an adjustable setpoint increase for the mixing valve.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit > Mixing circuit controller

Operating line	*Range*	*Factory setting*
Setp increase mixing valve	0…50 K	10 K

Setpoint increase mixing valve

Setpoint increase mixing valve 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.

10.10 Extra functions

10.10.1 Text designations

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit

Operating line	*Range*	*Factory setting*
Heating circuit	Max. 20 characters	Heating circuit
Time switch	Max. 20 characters	Time switch

The texts entered here appear on the menu and on the info display in place of the initial texts.

10.10.2 Acquisition of the room temperature

For the optimization functions and/or the influence on the flow temperature setpoint, the room temperature is required.

Extra configuration

The input is configured via the extra configuration:

Main menu > Commissioning > Extra configuration > Heating circuit > Inputs > Room sensor
Assign terminal

Averaging

A heating circuit can handle a maximum of 2 room temperatures. It is of no importance whether the room temperature is acquired locally or via KNX bus.
The average is generated from the 2 actual values.

Type of sensor

The type of room temperature sensor can be selected (example with input terminal RMK770.X4):

Main menu > Commissioning > Settings > … or
Main menu > Settings > Inputs > RMK770.X4 > Type

The following choices are available:

- LG-Ni1000
- 2 × LG-Ni1000
- T1
- Pt1000
- DC 0…10 V

A maximum of 2 LG-Ni1000 sensors can be connected to the same terminal. The controller does not automatically identify that. For this reason, in that case, 2 × LG-Ni1000 must be selected when parameterizing the terminal inputs..

Room temperature via bus

If the controller is connected to the bus, the room temperature signal can be sent or received via bus. In addition to the room zone, a valid device address must be set on the controller.
With default address 255, there is no communication via the bus.

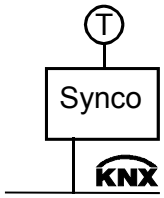
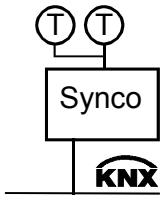
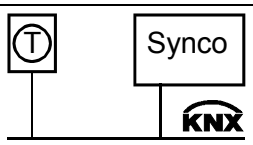
Sending

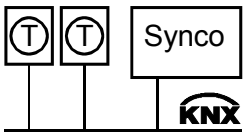
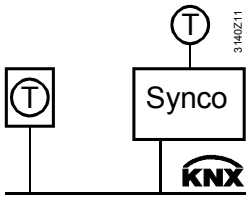
If the room temperature is acquired by the unit, it is delivered via bus in the heating circuit's room zone (geographical zone apartment) so that it is made available to all devices on the bus.
The room temperature can also be acquired by bus-compatible room sensors or room units (e.g. QAW740) and sent directly via bus. The associated room zone (geographical zone apartment) is to be set on the sensor or the room unit.

Receiving

The room temperature signal sent via bus is received by the heating circuit, provided the room zones (geographical zone apartment) of the transmitter and the recipient agree.

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 is sent across the geographical zone of the heating circuit.	
2 room sensors directly connected	The heating circuit operates with the average of the 2 sensors. When communication is activated, the average value is delivered as the room temperature across the heating circuit's geographical zone.	
1 room sensor (or 1 room unit QAW740)	When communication is activated, the heating circuit receives the room temperature of the same geographical zone. The heating circuit operates with the average of the 2 temperature signals received.	

Variant	*Effect*	*Diagram*
2 room sensors or 1 KNX room sensor and 1 room unit QAW740*	When communication is activated, the heating circuit receives the room temperature of the same geographical zone. The heating circuit operates with the average of the 2 temperature signals received.	
1 room sensor directly connected and 1 KNX room sensor (or 1 room unit QAW740)	When communication is activated, the heating circuit receives the room temperature of the same geographical zone. The heating circuit operates with the average of the 2 temperature signals received.	

* 2 QAW740 room units are not permitted! Operation in the room is only possible on one unit

Important

In the case of a room control combination with a ventilation system, the correct location of the sensors on the ventilation side must be observed.
Mounting the sensor for acquiring 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 operates with the wrong temperature when the ventilation plant is shut down!

10.10.3 Room control combination

The heating circuit of the RMK770 controller can be combined with a heating circuit of some other controller. This combination of 2 room control systems is required, for example, when 1 heating circuit is used for underfloor heating and 1 for radiators. 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 jointly 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 the 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 operating mode of the slave is on Comfort ☼ until the master sends another signal via bus.

For more detailed information about ventilation, refer to the Basic Documentation on the RMU7xxB (P3150).

Extra configuration

Main menu > Commissioning > Extra configuration > Heating circuit

Operating line	*Range*	*Factory setting*
Room control combination	Master / Slave external setpoint / Slave internal setpoint	Master

Settings

There are no settings required.
The room operating mode selector and the setpoints (if external) must be set on the master.

Communication

Main menu > Commissioning > Communication > Room heating circuit

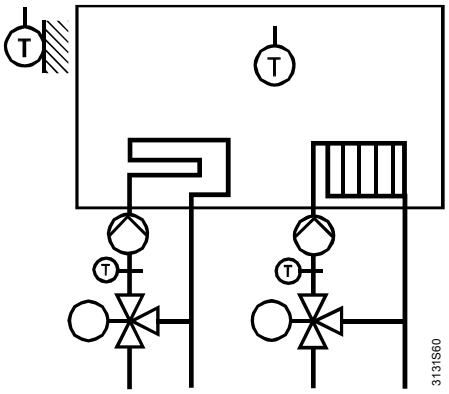
Operating line	*Range*	*Factory setting*
Geographical zone (apartment)	---- / 1…126	----

Communication is described in subsection 5.1.1 “Communication”.

Example with 2 heating circuits

Problem:

The basic load is covered by a heating circuit with weather-compensated control and the load-dependent part by a second heating circuit with or without room influence. The 2 heating circuits shall operate in parallel and be controlled by a common switching program or a room operating mode selector.



Solution:

Using the extra function “Room control combination”, 1 of the 2 heating circuits as the master can preselect the operating mode for the second heating circuit, which is configured as the slave.

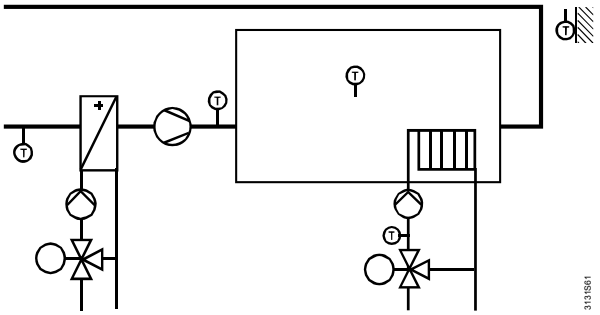
If required, the setpoints can also be adopted by the master. This is accomplished with configuration **Slave external setpoint**.

Example ventilation and heating

Problem:

A heating circuit covers the basic load and a ventilation plant covers the individual load (heat demand) from the space.

In this application too, a common time switch or common preselected operating modes may be desirable.



Combination of ventilation and heating

Solution:

Using the extra function “Room control combination”, the heating circuit can be operated as a slave whose room operating mode and time program are 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).

The 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 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 10.5.4 “Heating limit switch”) 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 "Type of optimization" with room temperature may not be activated.

10.11 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. In the event of an open-circuit or short-circuit, a fault status message is delivered.

The RMK770 has maximum 1 heating circuit. Index 1 indicates that the sensor error occurred in connection with this heating circuit.

Note

This section shows the text for each fault number with which the controller is supplied. Text with [HC …] can be changed on the password level.

Sensor fault flow temperature

Number	*Text (as supplied)*	*Effect*
50	[HC 1] error flow sensor	Nonurgent message; must be acknowledged

In the event of a faulty flow sensor, the mixing valve is driven to the fully closed position to become inactive (in case of a 3-position actuator); it can then be operated manually.

Sensor fault return temperature

Number	*Text (as supplied)*	*Effect*
51	[HC 1] error return sensor	Nonurgent message; must be acknowledged

Behaves like a heating circuit without return temperature sensor. Return temperature limitation is inactive.

Sensor fault room temperature

Number	*Text*	*Effect*
60	Room sensor error plant 1	Nonurgent message; must not be acknowledged
61	>2 room sensors in plant 1	Urgent message; must be acknowledged. More than 2 room temperature sensors in the same geographical zone

Sensor fault outside temperature

Number	*Text*	*Effect*
10	Outside temp sensor error	Nonurgent message; must not be acknowledged
11	>1 outside temperature sensor	Urgent message; must be acknowledged. More than 1 outside sensor in the same outside temperature zone.
12	Outs sensor simulation active	Nonurgent message; must not be acknowledged

Fault room control combination

Number	*Text*	*Effect*
5401	Room master failure in plant 1	Nonurgent message; must not be acknowledged No master
5402	>1 room master [1]	Nonurgent message; must not be acknowledged. More than 1 master

Fault heating circuit pump

Number	*Text (as supplied)*	*Effect*
2521	[Heat circuit pump] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: ”Acknowledgement“
2522	[Heat circuit pump B] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: ”Acknowledgement“
2523	[Heat circuit pump] no flow	Nonurgent message; must be acknowledged and reset
2524	[Heat circuit pump B] no flow	Nonurgent message; must be acknowledged and reset
2525	[Heating circuit pump] fault	Urgent message, must not be acknowledged, plant stop

10.12 Diagnostic choices

Inputs/setpoints

■ Main menu > Heating circuit > Inputs/setpoints

Operating line	*Adjustable values / remarks*
Composite outside temp	…°C
Attenuated outside temp	…°C
Actual value flow temp	…°C
Flow temperature setpoint	According to section 10.6 “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	
Current room temp setpoint	…°C; according to user’s preselection, current room operating mode and interventions
Economy increase	Inactive / Active
Room setpoint absolute	…°C
Room setpoint relative	…°C
Actual value return temp	…°C
Return temperature max	…°C
Room operating mode	…°C
Timer function	
[Heating circuit pump] overload	0 / 1 (1 = overload)
[Heat circuit pump B] overload	0 / 1 (1 = overload)
Flow signal pump	0 / 1 (0 = no flow)
Optg hours pump	0…99999 h
Optg hours pump B	0…99999 h
Room operating mode	0 / 1 (1 = preselected operating mode)
Timer function	0 / 1 (1 = timer function)
Special day input	0 / 1 (1 = switching program according to special day is active)
Holiday input	0 / 1 (1 = operation according to holiday settings)

When making diagnostics or the wiring test, logic states are displayed. The input is active when 1 appears on the display. If “Normal position open“ is selected, this is the case when the contact is closed; if “Normal position closed“ is selected, this is the case when the contact is open.

Outputs

■ Main menu > Heating circuit > Outputs

Operating line	*Adjustable values / remarks*
Mixing valve position	0…100% (3-position or 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 > Limitations

Operating line	*Adjustable values / remarks*
Flow temperature max	Inactive / Active
Flow temperature min	Inactive / Active
Flow temperature increase	Inactive / Active
Return temperature max	Inactive / Active
Pulse limitation	Inactive / Active

11 Data acquisition

11.1 Trend

11.1.1 Connections and use

Purpose

Function block ”Trend” is used for time-related recording of measured values.
It provides 4 independent trend channels.

A trend channel can record **1** measured value.

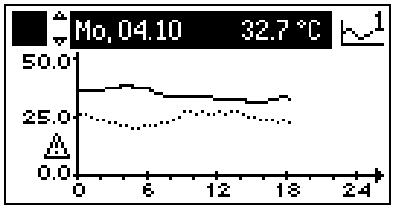
Each trend view can display 2 trend channels: Primary channel plus extra channel as a reference.

It is possible to record signals from local inputs of the controller plus room and outside temperatures via bus.

11.1.2 Views

Example

The following illustration shows a 24-hour view on the operator unit with primary trend curve and reference curve of an extra channel:



Contents

- The current 24-hour views (8 minutes, 8 hours, 24 hours) show the date and the current value of the primary trend curve at the top
- The primary trend curve is shown as a solid line, the reference curve as a dotted line
- The Y-axis label refers to the settings of the primary channel. If the Y-axes of the 2 channels do not match, a warning symbol appears below the axis

Change between views

Use the select-and-push knob on the operator unit to navigate between the 4 different views:

- 8-minute view: Sampling every 5 seconds, last 8 minutes
- 8-hour view: Sampling every 5 minutes, last 8 hours
- 24-hour view: Sampling every 15 minutes, current day
- Rolling over the last 6 days: Sampling every 15 minutes, last 6 days

Note:

The 24-hour view shows the last 6 days.

11.1.3 Trend function settings

Settings

Main menu > Settings > Data acquisition > Trend > Trend channel 1...4

Operating line	*Adjustable values / remarks*
Trend channel 1… Trend channel 4	Channel name (editable text, max. 20 characters)
Trend signal	Assign trend signal: ---, room temperature via bus, outside temperature via bus, N.X1…A9(3).X4
Geographical zone (apartment)	1…126 Relevant only if "Room temp via bus" is selected
Geographical zone (room)	1…63 Relevant only if "Room temp via bus" is selected
Outside temperature zone	1…31 Relevant only for "Outside temp via bus"
Y-axis min	Depending on selected type
Y-axis max	Depending on selected type
Selection extra channel	Trend channel 1…Trend channel 4

Explanations relating to the settings

A trend channel is activated by assigning a "Trend signal" to it.

Each trend channel can be assigned a plant-specific text with max. 20 characters via operating line "Trend channel x".

The bus address of the room for which the room temperature is to be recorded can be set via the "Geographical zone".

To acquire the outside temperature via bus, set the relevant "Outside temperature zone".

The Y-axes can be scaled for each trend channel. Datapoints "Y-axis min" and "Y-axis max" refer to the value display and must be set according to the expected signal range. There is no trend display if the current values are outside the selected range!

A second trend channel can be shown via operating line "Selection extra channel". This channel is displayed as a dotted line.

Notes on the extra channel

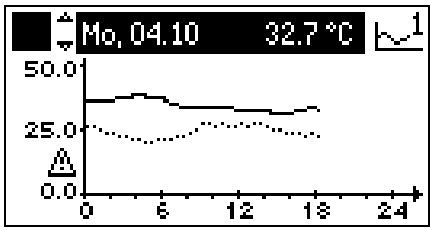
Only every second measured value is displayed for the extra channel; thus, the value to be measured should be put on the main channel.

The Y-axis label only refers to the primary channel. The extra channel is displayed according to its Y-axis settings. If the axes differ, a warning triangle appears next to the axis.

Display values

The trend channels can be called up via the following menu:

Main menu > Data acquisition > Trend channel 1...4



The trend channels are displayed with the text assigned to them.
When a trend channel is selected, the display immediately switches to the 24-hour view. The select-and-push knob allows you to navigate between the different views.

11.2 Fault handling

Trend signal not available

If a trend signal at the local inputs is no longer available (e.g. due to a faulty sensor), trends are no longer recorded.
In this case, observe the fault status messages under:

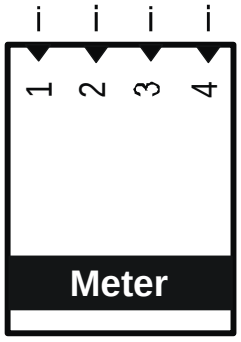
■ Main menu > Faults > Faults current

If the values are not available via bus, trends are no longer recorded.

Power failure or restart

After a power failure or when quitting the Extra configuration menu (restart controller), the values of the 8-hour and 8-minute views are deleted.
However, the values of the 24-hour view and those of the last 6 days are retained.

11.3 Meters



i 1 Meter input 1
i 2 Meter input 2
i 3 Meter input 3
i 4 Meter input 4

11.3.1 Configuration

Extra configuration
The meters are activated in the extra configuration by assigning a terminal to the meter's input.

Main menu > Commissioning > Extra configuration > Data acquisition > Meter 1 (or 2, 3 or 4)

Settings

Operating line	*Range*	*Factory setting*
Input 1 (etc. up to input 4)	--- / RMK770.X1, 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

Datapoint "Displayed unit" is used to select the unit to be displayed. Datapoint "Displayed format" defines the number of decimal places.

11.3.2 Meter types

Meters are used to acquire consumption values.
Pulses from the following types of meter can be handled:

- Gas meters
- DHW meters
- Drinking water meters
- Electricity meters

The pulse values represent:

- Energy in kJ, MJ, GJ, Wh, kWh **or** MWh
- Volume in m^3, l **or** ml
- Variables without unit (max. 3 decimal places)
- Heat cost unit
- BTU (British Thermal Unit)

The pulses are converted to consumption values as per the setting values, added, and the cumulated values are stored as 15-month values at midnight upon month rollover. The meters are used to optimize plant operation. Also, they are mandatory for pulse limitation.

Types of meter

The following types of meter can be used:

- Mechanical pulse sources (Reed contact) without Namur circuit with a maximum pulse frequency of 25 Hz and a minimum pulse duration of 20 ms
- Electronic pulse sources with 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 and less bouncing pulses than mechanical pulse sources, such as relays or Reed contacts.
To ensure full flexibility of use, the type of meter can be selected:

Setting

Main menu > Commissioning > Settings > .... or

Main menu > Settings > Inputs > RMK770.X... (or RMZ78....)

Operating line	*Range*	*Factory setting*
Type	Mechanical / Electronic	Mechanical

Notes on “Meter 1“

Each meter can be assigned a name (refer to subsection 11.3.7 “Assignment of texts“). If text is entered and the meter is called up, the meter’s name appears in place of “Meter 1“ (or 2, 3 or 4).

Notes

- The pulse counter integrated in the RMK770 controller is not suited for billing purposes due to insufficient accuracy. Only direct meter readings (heat meters, electricity meters, etc.) deliver valid values
- Meters using Namur or S0 circuitry are not supported
- A total of 4 independent meters are available

11.3.3 Pulse valency

Every pulse delivered by a pulse source corresponds to a certain consumption value. The pulse valency is printed on the consumption meter. Pulse valency 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

11.3.4 Overflow value

The overflow value ensures that the displayed readings on the connected meter and on the RMK770 controller are identical. The value at which the meter's display returns to 0 can be set.
Unit and decimal place depend on the unit and the format.
The overflow value can only be changed with the OCI700.1 service tool.

Main menu > Commissioning > Settings or

Main menu > Settings > Data acquisition > Meter 1 (or 2, 3 or 4)

Operating line	*Range*	*Factory setting*
Overflow value	0…999'999'999	99'999'999 kWh

11.3.5 Setting and resetting meter readings

In case of deviations, service staff can adjust the pulse meter reading via datapoint "Meter reading current". This value can only be changed with the OCI700.1 service tool.

Datapoint "Reset monthly values" allows for deleting the last 15 monthly values. The current meter reading is retained.

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

11.3.6 Meter readings

Each meter shows:
- The current reading
- The reading per month and the date associated with the reading over the last 15 months

Display values

Main menu > Data acquisition > Meter 1 (or 2, 3 or 4)

Operating line	*Remarks*
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 always stored at midnight at the end of the month.
Using datapoint "Monthly values", the 15 monthly values can be reset or deleted on the password level.

11.3.7 Assignment of texts

Each meter can be assigned specific text. This text appears on the operating pages in the form of menu text and datapoint text.

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

11.3.8 Fault handling

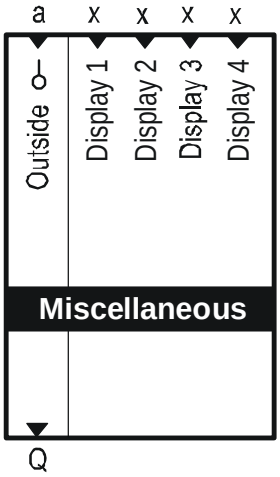
Battery-powered and mechanical meters also continue to operate in the event of a power failure. If power supply to the RMK770 controller fails, the pulses are not counted.
When the Extra configuration menu is quit, a restart is made. Pulses received between last storage and restart (maximum 5 minutes) are not counted.

Fault status messages

No.	*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 automatically provided for all basic types. To activate the function block, special basic configuration is not required.

Extra configuration

The functions required for the plants can be activated in the extra configuration.

Inputs

Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs

Operating line	*Adjustable values / remarks*
Outside temperature	
Display input 1	
Display input 2	
Display input 3	
Display input 4	

Outputs

Main menu > Commissioning > Extra configuration > Miscellaneous > Outputs

Operating line	*Adjustable values / 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 section 4.5.4 „Electronic business card“.

12.3 Outside sensor

An outside sensor can be connected to the RMK770. It can be used for the following purposes:

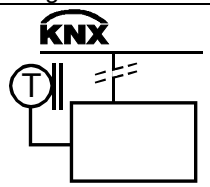
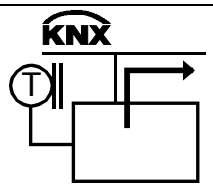
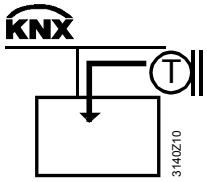
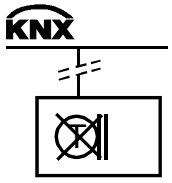
- Compensating variable for the heating circuit
- Compensating variable for the heat demand transformers
- For certain frost protection functions
- For locking the boilers as a function of the outside temperature

Connection choices

The outside temperature can be delivered by different sources:

- Locally connected to a terminal
- Delivered via bus

The following variants are available:

Variant	*Effect*	*Diagram*
Outside temperature locally at terminal. Communication outside temperature not active	Controller operates with its own outside temperature. No impact on the bus	
Outside temperature locally at terminal. Communication outside temperature active	Controller operates with its own outside temperature. The outside temperature is also made available to other controllers via bus	
No outside temperature locally. Communication outside temperature active	The controller operates with the outside temperature delivered by some other controller via bus	
No outside temperature locally. Communication outside temperature not active	The controller has no outside temperature to work with	

The type of outside sensor can be selected under Settings > Inputs at the assigned terminal. Default setting is an LG-Ni1000 sensor.
Connection of an NTC575 sensor (e.g. QAC32) is not possible.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs

Operating line	*Range*	*Factory setting*
RMK770… (or RMZ78…)	Ni1000 / 2×Ni1000 / T1 / Pt1000 / 0…10 V	Ni1000

Outside temperature via the bus

The outside temperature signal can be transmitted to other controllers via bus or it can be received by the bus. For that purpose, communication must be activated and an outside temperature zone must be 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 transmitted 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. The relevant settings are described in chapter 14 „Communication".

Configuration

Main menu > Commissioning > Communication > Distribution zones

Operating line	*Range*	*Factory setting*
Outside temperature zone	---- / 1…31	----

12.3.1 Outside temperature simulation

To test the response of the plant, an outside temperature can be simulated and the measured value of the outside temperature (outside sensor or bus) can be overridden.

Main menu > Miscellaneous > Inputs

Operating line	*Range*	*Factory setting*
Outside temperature simulation	---- / –50.0…+50.0 °C	----

During the simulation, it is also the simulated outside temperature that is used for the composite and the attenuated outside temperature.

Caution

The simulation is **not** automatically terminated (no time-out supervision!).

The inputs should only be overridden by qualified staff and within a limited period of time only!

During the simulation, fault status message “Outside sensor simulation active” appears. This message is present until the outside temperature simulation is set back to “----“. This is to make certain that the plant cannot be quit without terminating the simulation.

Note

The simulated outside temperature is only used locally. It is **not** delivered 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 if the bus receives a sensor value. In the case of an open-circuit or short-circuit, fault status message “Outside temp sensor error“ appears. Internally, the controller continues to operate using 0 °C as a backup value.

Fault status message “Outside temp sensor error“ also appears when there is no signal via bus. If other outside temperatures are available via bus, the one used is the outside temperature first transmitted.

Only 1 outside temperature can be present in the same zone. If several controllers send their outside temperature to the same zone, fault status message “>1 outside temperature sensor” is delivered.

Fault status messages

Number	*Text*	*Effect*
10	Outside temp sensor error	Nonurgent message; must not be acknowledged
11	>1 outside temperature sensor	Urgent message; must be acknowledged
12	Outs sensor simulation active	Nonurgent message; must not be acknowledged

12.4 Display inputs

On the RMK770, 4 universal inputs can be defined for display purposes.

Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs

Operating line	*Adjustable values / remarks*
Display input 1	Assign terminal
Display input 2	Assign terminal
Display input 3	Assign terminal
Display input 4	Assign terminal

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	Like display input 1	°C
Display input 3	Like display input 1	°C
Display input 4	Like display input 1	°C

For detailed information about resolution, type of sensor, etc., refer to subsection 3.4.7 “Configuration of the universal inputs and outputs”.

The type of input can be selected. In the case of an analog input, it is the type of input, and in the case of a digital input, the normal position.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs > ...X...

Operating line	*Range*	*Factory setting*
Type reference	Ni1000 / 2×Ni1000 / T1 / Pt1000 / 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 inputs can be assigned free text (maximum 20 characters).

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Texts

Operating line	*Range*	*Factory setting*
Display input 1	Max. 20 characters	
Display input 2	Same as display input 1	
Display input 3	Same as display input 1	
Display input 4	Same as display input 1	

For more detailed information about the configuration of analog inputs, please refer to subsection 3.4.7 “Configuration of the universal inputs and outputs”.

12.5 Outside temperature relay

Extra configuration

The function must be activated via the extra configuration:

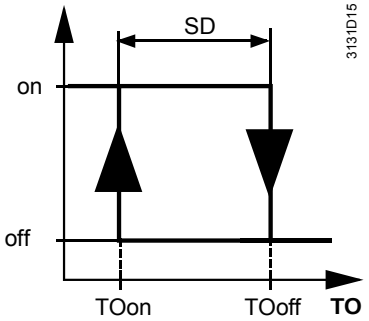
Main menu > Commissioning > Extra configuration > Miscellaneous > Outputs > Outside temperature relay Assign terminal

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Outputs > 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 is opened again when the outside temperature returns to a level above the switch-off point.

Example:

Switch-off point = 5 °C
Switching differential = 3 K
The relay contact closes when the outside temperature drops below 2 °C; it opens when the outside temperature exceeds 5 °C.

12.6 Diagnostic choices

Main menu > Miscellaneous > Inputs

Operating line	*Range*
Actual value outside temp	…°C
Display input 1	According to the input identifier
Display input 2	According to the input identifier
Display input 3	According to the input identifier
Display input 4	According to the input identifier

Main menu > Miscellaneous > Inputs

Operating line	*Range*
Outside temperature simulation	…°C

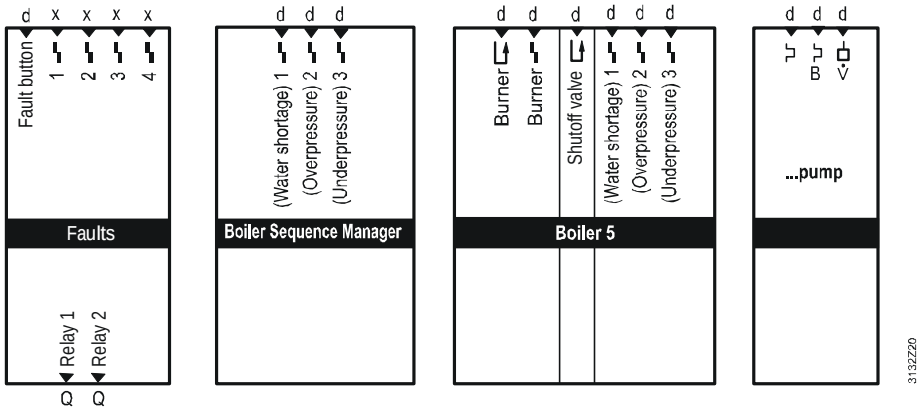
Main menu > Miscellaneous > Outputs

Operating line	*Range*
Outside temperature relay	Off / On

13 Function block “Faults“

13.1 Overview of function block

The task of function block “Faults” is to collect and evaluate all fault status messages, and to trigger appropriate actions to prevent damage to the building and plant.
The function block is always active for internal fault status messages. In the extra configuration – in addition to the fault inputs of the boiler sequence manager, the fault inputs of boilers 1 through 6 and pumps – up to 4 inputs can be activated as fault inputs for external signal sources.
It is also possible to monitor inputs that have already been configured (e.g. the main flow sensor).
To signal faults, 2 relays can be configured as fault outputs.



13.2 Configuration

Extra configuration

In the extra configuration, a maximum of 4 universal fault inputs and 2 fault relays can be configured.

The inputs can be configured to free inputs, or analog inputs that are already used can be monitored for limit value crossings.

Inputs

Main menu > Commissioning > Extra configuration > Faults > Inputs

Operating line	*Adjustable values / remarks*
Fault button external	RMK770…, RMZ7… (digital only)
Fault input 1	Analog or digital inputs
Fault input 2	
Fault input 3	
Fault input 4	

Outputs

Main menu > Commissioning > Extra configuration > Faults > Outputs

Operating line	*Adjustable values / remarks*
Fault relay 1	RMK770…, RMZ7…
Fault relay 2	RMK770…, RMZ7…

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 is not lit	No fault present
Button blinks	• There is a fault which has not 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 be no longer detected, demanding on acknowledgement which has not yet been made. After pressing the button, blinking stops
Button is lit	There is a fault which has already been acknowledged

Fault relay

A fault relay, if present, remains energized as long as the button blinks or is lit. For more detailed information, refer to section 13.11 „Display of faults“.

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 according to the following pattern:
- Acknowledge the fault relay (only, if a fault relay has been configured)
- Acknowledge all fault status messages present in the device
- Fault status messages with self-holding can only be reset when the fault is no longer present

Acknowledging faults

Faults can only be acknowledged on the device where the fault is present.

Resetting the fault relay

Fault relays can only be reset on the device with the configured fault relays.

13.4 External fault button

The ”Faults” block has an optional connection facility for an external fault button. The external fault button provides the same function as fault button on the device. 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	RMK770…, RMZ7… (digital only)

13.5 Fault properties

Faults are distinguished by their properties. There are faults with regard to:
- Acknowledgement and reset
- Signal priority
- Plant behavior

13.5.1 Acknowledgement and reset

No acknowledgement (simple fault)

There is no acknowledgement required for these types of fault.

Example

If the outside temperature is missing, a fault status message is delivered. When the outside temperature is available again, the fault status message automatically disappears and the plant resumes normal operation.

Acknowledgement (standard fault)

These types of fault require an acknowledgement.

Example

If a plant uses more than 1 time switch master in the same geographical zone, this fault status message must be acknowledged.

Acknowledgement and reset (extended fault)

There is an acknowledgement and a reset required for this type of fault.

Example

If both pumps of the twin pump signal a fault, the fault status message must be acknowledged and – after correction of the fault – be reset by pressing the fault button a second time.

13.5.2 Signal priority

Priority urgent

Fault status messages are called urgent when correct operation of plant can no longer be ensured.
For example, “Boiler sensor error” would be an urgent fault status message.

Priority nonurgent

Nonurgent fault status messages
- do not adversely affect the plant operation directly
- allow plant to operate with restrictions

A nonurgent fault status message would be “Outside temp sensor error“, for example.

13.5.3 Plant behavior

There are:
- Faults with plant stop or aggregate stop
- Faults without plant stop or aggregate stop

Whether a fault leads to an aggregate stop (e.g. shutting boiler down and deactivating pumps) or a plant stop (shutting all boilers down) depends on the type of fault.
Faults of a boiler or faults of a boiler pump also lead to shutdown of the relevant boiler.
A fault of the boiler sequence manager can cause the entire multiboiler plant to shut down.
The universal fault inputs only lead to a plant stop if “Stop” is parameterized.

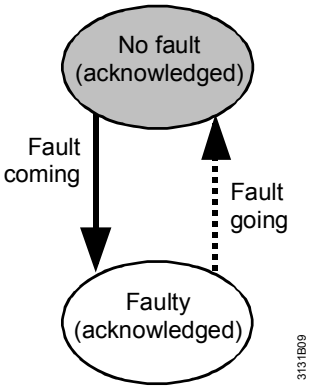
Examples

Number	*Text*	*Effect*
5201	Hol/spec day program failure	Nonurgent message; must not be acknowledged
5102	>1 time switch in plant 1	Nonurgent message; must be acknowledged
10	Outside temp sensor error	Nonurgent message; must not be acknowledged
2491	[Main pump B] overload	Contact overload B active. Nonurgent message; must be acknowledged
2492	Main pump] fault	Main pump has failed. Urgent message; must be acknowledged

13.6 State diagrams of the individual types of fault

Simple fault

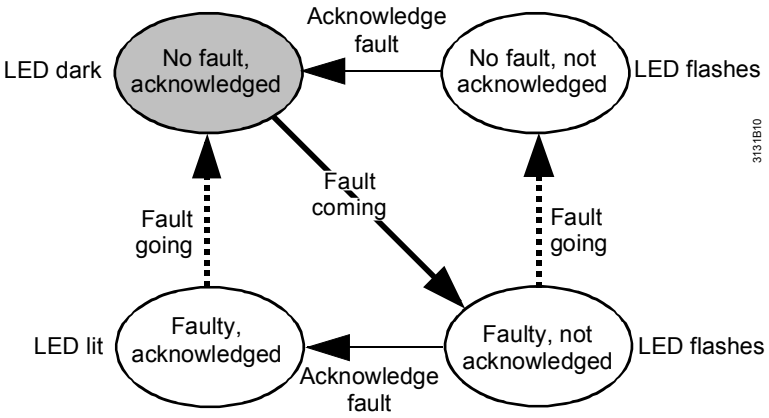
A simple fault need not be acknowledged. If there is a fault relay (see below), it must be reset, however.



When there is a simple fault, the LED is lit. When the fault is corrected, the LED extinguishes.
If a fault relay is configured, the LED blinks 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 extinguishes.

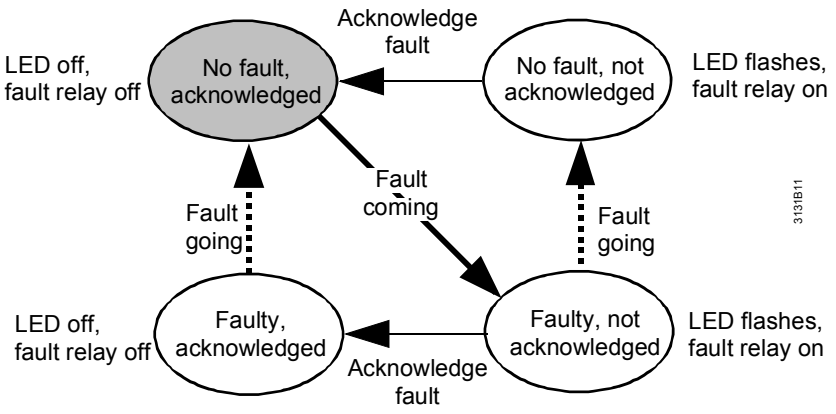
Standard fault

A standard fault must be acknowledged.



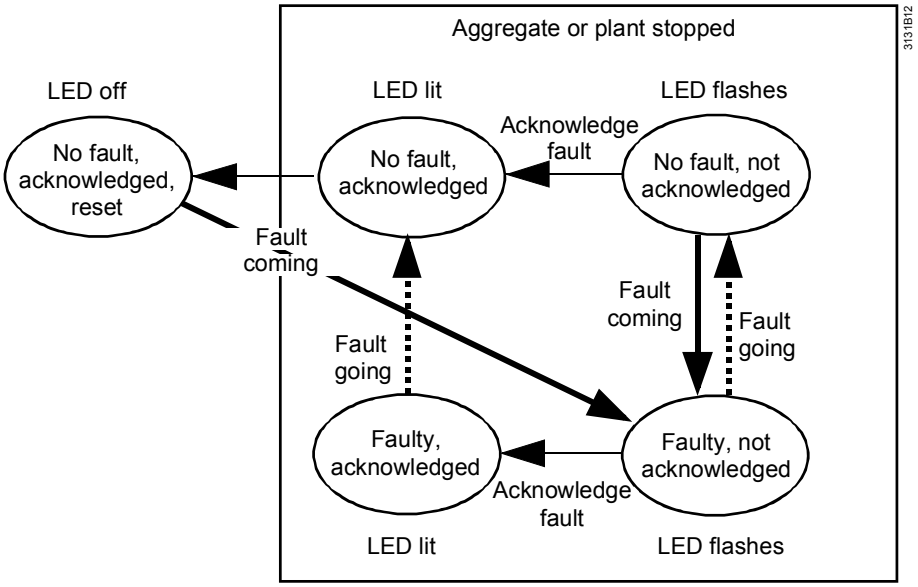
The LED blinks as long as the fault is not acknowledged. If the fault is still present, the LED will be lit after acknowledgement.

Standard fault with configured fault relay



Extended faults

Extended faults are faults that must be acknowledged **and** reset. This is the case with a twin pump, for example, when both pumps signal a fault. The pumps start running again only after the fault has been acknowledged, corrected and reset.



13.7 Predefined fault inputs

With function blocks “Boiler sequence manager“, “Boiler 1…6” and the pump blocks, predefined fault inputs are available.
For a description of these fault inputs, refer to the relevant function blocks. The parameters of these fault inputs are also set on the respective function blocks.

13.8 Fault inputs

13.8.1 Universal fault inputs

The RMK770 provides 4 universal fault inputs. These can be activated in the extra configuration.
Analog or digital inputs can be defined as fault inputs. Inputs D1 and D2 at the RMK770 can only be used as digital 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 identifiers

Operating line	*Range*	*Factory setting*
Fault input 1	°C / % / g/kg / kJ/kg / W/m2 / m/s / bar / mbar / Pa / ppm / Universal 0000.0 / Universal 000.0 / Universal 0000 / Digital	Digital
Fault input 2	Like fault input 1	Digital
Fault input 3	Like fault input 1	Digital
Fault input 4	Like 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 > RMK770.D... (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 signal delay	00.00…59.55 m.s	00.05 m.s
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	None
Fault priority	Urgent / Nonurgent	Nonurgent
Impact of fault	No stop / Stop	Stop
Limit value fault on	0 / 1**	1
Limit value fault off	0 / 1**	0

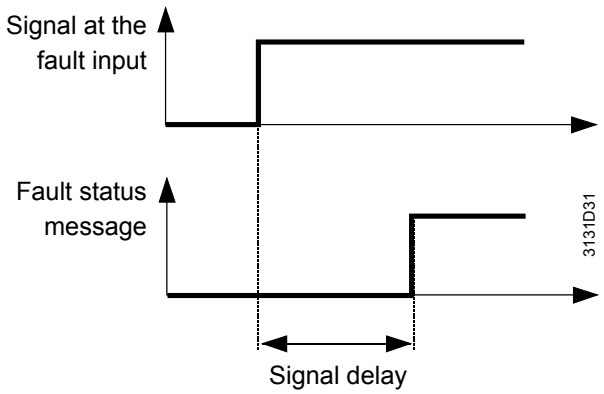
* Or fault input 2, 3 or 4
** Depending on the "Input identifier"

These settings can be made only if the relevant input has previously been activated in the extra configuration.
For more detailed information, refer to section 13.5 "Fault properties".

Fault text

The text for the universal fault inputs is predefined via [Fault input 1]Fault through [Fault input 4]Fault. The texts can be adapted.

Fault status signal delay



The fault status signal delay is used to set the period of time a fault must be pending to be handled as such.

Fault effect

When parameterized "Stop" at the universal fault inputs, the controller switches off all function blocks (boiler sequence manager, all boilers, primary controller, and the heating circuit). Frost protection continues to be active.

Fault status messages

Number	*Text*	*Effect*
9000	>1 fault input fault	Urgent message; must not be acknowledged (effect at each fault input can be selected)
9001	[Fault input 1] fault *	Effect according to settings
9002	[Fault input 2] fault *	Effect according to settings
9003	[Fault input 3] fault *	Effect according to settings
9004	[Fault input 4] fault *	Effect according to settings

* Factory setting; text is editable

>1 fault input fault

The fault with the highest priority is sent via KNX bus. If more than 1 fault input with priority “Urgent“ want to signal a fault, message ”>1 fault input faulty“ is delivered with the highest priority. Without this fault status message, the message from only 1 fault input would appear.

Fault handling

The digital status inputs cannot be monitored. We recommend to use wiring ensuring that the signal drops out when a fault is 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 be monitored to ensure that the maximum flow temperature will not be exceeded.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Faults > Fault input ...

Operating line	*Range*	*Factory setting*
Limit value fault on	0 / 1*	1
Limit value fault off	0 / 1*	0

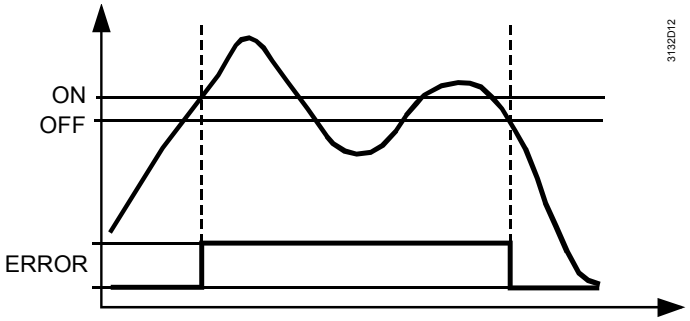
* Depending on the input identifier (the example here applies to a digital input)

If “Limit value fault on“ is greater than “Limit value fault off”, the input is monitored for overshoot.

Example

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 removed.

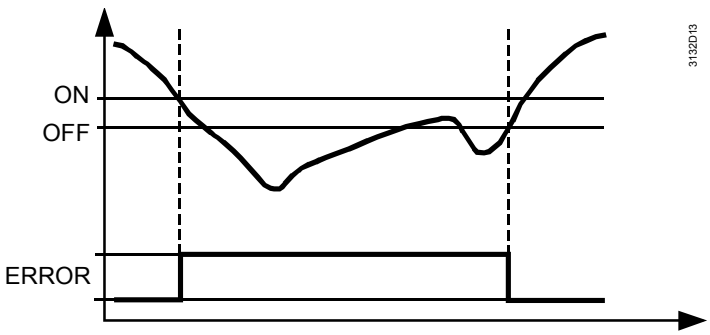


If “Limit value fault off“ is greater than “Limit value fault on”, the input is monitored for undershoot.

Example

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 removed.



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™ 700 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 the self-holding reset 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

A controller cannot acknowledge any fault status messages on other controllers.

13.10 Fault relays

To forward fault status messages, or to indicate them optically or audibly on a control panel, for instance, 2 fault status 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
- Signalling:
  The following signalling variants can be selected:
  - Internal fault (optically): The fault relay only signals internal faults and remains energized until faults are no longer pending
  - Internal fault (audibly): The fault relay only signals internal faults and remains energized until the fault is acknowledged
  - Fault via bus (audibly): The fault relay only signals from the bus and remains energized until the fault is acknowledged
- Inversion:
  - No means that the relay is energized should a fault occur
  - Yes means that the relay is deenergized should a fault occur

Setting values

Main menu > Commissioning > Settings or

Main menu > Settings > Faults > Fault relay 1 (or 2)

Operating line	*Range*	*Factory setting*
Fault priority	Urgent / Nonurgent / All	All
Indication of fault*	Fault internal (optically) / Fault internal (audibly) / Fault via bus (audibly)	Fault internal (audibly)**
Inversion	No / Yes	No

* Maximum 1 bus fault status message can be handled, even if they have different priorities
Recommendation: Do not configure 2 bus fault relays

** Factory setting fault relay 2: “Fault via bus (audibly)“

Display values

Menu item Miscellaneous shows the state of both fault relays.

Main menu > Miscellaneous > Outputs

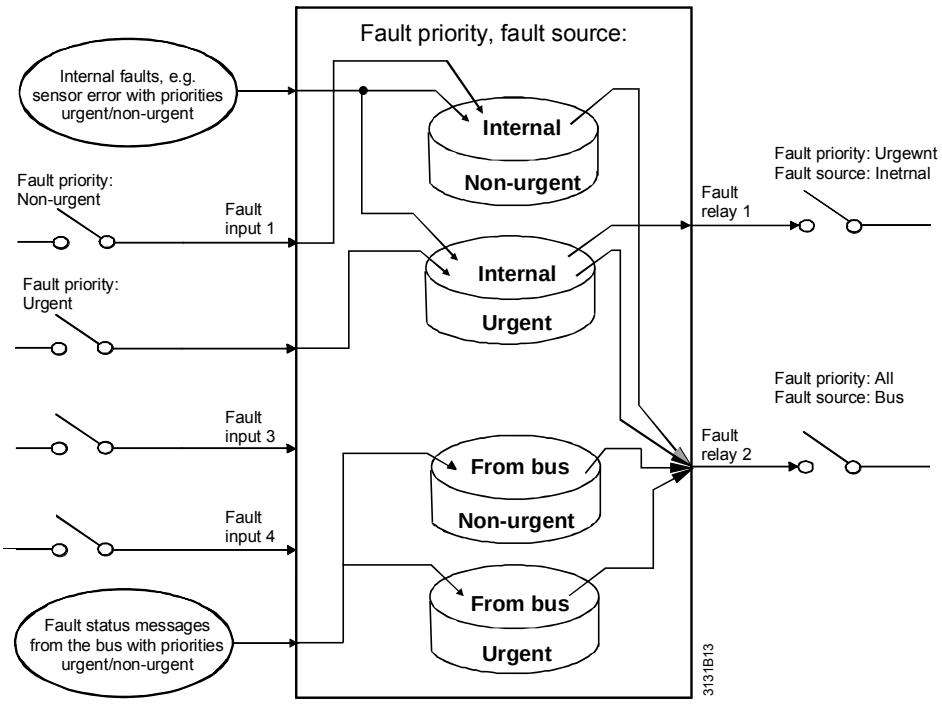
Operating line	*Current state*
Fault relay 1	Off / On
Fault relay 2	Off / On

Example

Problem:

2 relays are configured as fault relay 1 and fault relay 2. Fault relay 1 shall signal all internal fault status messages having priority “Urgent”. Fault relay 2 shall signal all fault status messages (internal and from the bus), irrespective of their priority.
At fault input 1, the fault monitored shall be identified and signaled as nonurgent; at fault input 2, the fault monitored shall be identified and signaled as urgent.

Solution:



13.11 Display of faults

The current state of the fault status messages can be interrogated on the operator unit.

Faults current

The current faults include all faults currently pending. A maximum of 10 faults can be displayed. Following is displayed with every fault:

- Fault text
- Fault number
- Time of day and date the fault occurred

Fault history

Here, the last 10 faults are displayed. Here too, following is displayed with every 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 and the time of day and date the fault occurred, plus 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

Operating line	*Remarks*
Faults current	
Fault history	
Fault status message bus	

13.12 Deletion of all fault status messages

Using menu item Delete faults, the “Fault history” list can be cancelled.

Functions

Main menu > Faults

Operating line	*Remarks*
Delete faults	Current faults are reset, ”Fault history“ list is canceled

When activating this function, all other fault status messages are also reset. Hence, only pending faults continue to be displayed.

Note

If the kind of acknowledgement with a pending fault is changed, it can 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 Function check and wiring test

During the wiring test, the fault status inputs can be switched directly via the control switch.

Wiring test

Main menu > Commissioning > Wiring test > Faults > Inputs

Operating line	*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)

When making diagnostics or the wiring test, logic states are displayed. The input is active when 1 appears on the display. If “Normal position open“ is selected, this is the case when the contact is closed; if “Normal position closed“ is selected, this is the case when the contact is open.

Main menu > Commissioning > Wiring test > Faults > Outputs

Operating line	*Range*
Fault relay 1	Off / On
Fault relay 2	Off / On

13.14 Diagnostic choices

Inputs

Main menu > Miscellaneous > Inputs

Operating line	*Range*
Fault button external	0 / 1 (1 = active)
Fault input 1	According to the configuration
Fault input 2	According to the configuration
Fault input 3	According to the configuration
Fault input 4	According to the configuration

Outputs

Main menu > Miscellaneous > Outputs

Operating line	*Range*
Fault relay 1	Off / On
Fault relay 2	Off / On

Display of faults

Main menu > Faults > Faults current

Operating line	*Adjustable values / remarks*
Fault 1…	
…fault 10	

Main menu > Faults > Fault history

Operating line	*Adjustable values / remarks*
Fault 1…	
…fault 10	

Main menu > Faults > Fault status message bus

Operating line	*Adjustable values / remarks*
Fault status message bus	

Deleting faults

Main menu > Faults > Delete faults

Operating line	*Adjustable values / remarks*
Fault history will be deleted	

14 Communication

A detailed description of communication is given in Basic Documentation “Communication via KNX bus” (P3127). In the following, the most important settings required for commissioning a multiboiler plant are described.

Activating communication

Communication is activated when the following conditions are satisfied:

- The device address has been entered (every bus user requires an individual device address)
- Bus power supply is available
- The bus device is not in commissioning mode

Process data exchange

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 allow for communication, it is therefore sufficient to create a common zone.

Plant assignment of the devices is of no importance. The plants can be can be assigned to the same RMK770 controller or to different KNX devices interconnected via bus.

14.1 Basic settings

Before the zone allocations 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	No

The settings made here are also displayed under:

Main menu > Device information > Communication > Basic settings

Device address

Every bus user must have 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

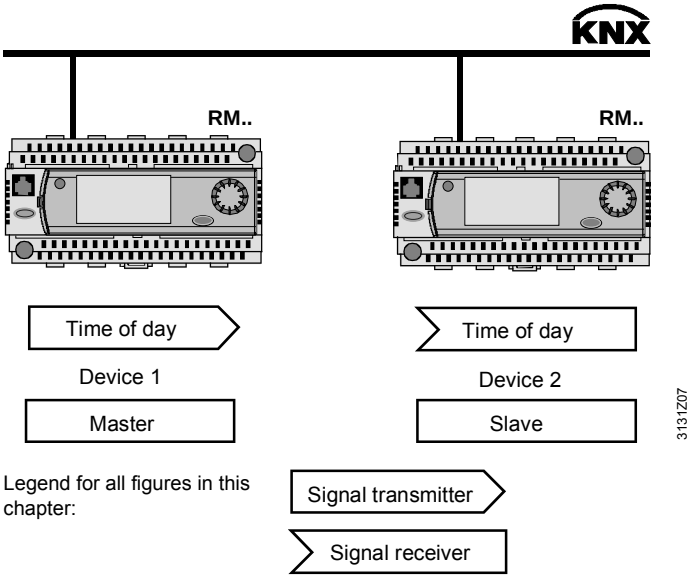
For small plants (maximum 8 devices), decentral power supply is adequate. This represents the factory setting). For detailed information, refer to Data Sheet “KNX bus” (N3127) and Basic Documentation “KNX communication” (P3127).

Clock time operation

When selecting “Autonomous”, the device does not receive or send the time of day. If the system shall use a common time of day, one of the devices is to 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 slave.
The new values are sent to the clock master via KNX 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.



Remote reset of fault

Effects when communication is activated:

- Fault status messages are always delivered via bus and can be further handled by other Synco™ 700 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™ 700 devices can be delivered to a fault relay

All fault status messages can be acknowledged from a remote location (e.g. from the PC operator station or via the OCI700 service interface).
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)

The RMK770 controller has a calendar for the entry of holidays and special days. If required, a calendar of another Synco™ 700 device can be used.
Optionally, other Synco™ 700 devices can use the RMK770 calendar.
This is made possible via the following communication settings:

Communication

Main menu > Commissioning > Communication > Room heating circuit

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

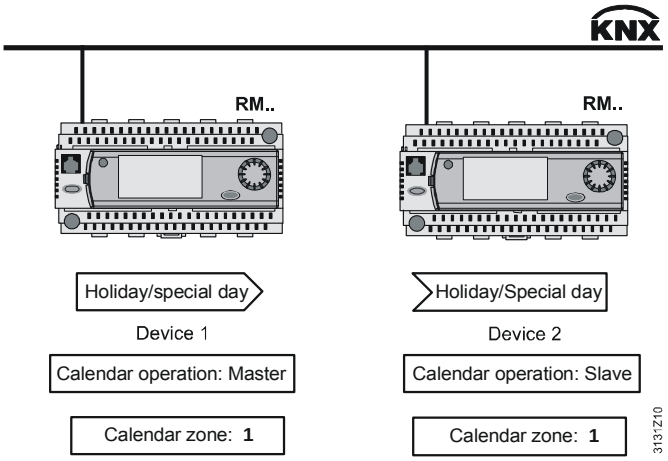
The settings made are also displayed under:
Main menu > Device information > Communication > ...

Holidays/special day operation

If a common holiday or special day program shall be used, holidays/special day operation must be defined as the master on one of the devices, and the other(s) is (are) slave(s). Operation with the 4 internal calendars is analogous.

Holidays/special day zone

With master-slave operation, this setting is used to assign the zones. The slaves are assigned the same holidays/special day zone as the master. It is possible the define several zones with 1 master per zone.



14.3 Room data

Every heating circuit belongs to a geographical zone. The zone represents the room to be controlled. Within the zone, the data related to the room are exchanged:

- The room operating mode
- The room temperature
- The setpoints

14.3.1 Communication variants

The requirements (operation, function) placed on the generation of the room operating mode vary considerably, depending on the type of building and building usage. The communication variants described below make it possible to match the room operating mode to the relevant requirements.

14.3.2 Settings

Communication

Main menu > Commissioning > Communication > Room heating circuit

Operating line	*Range*	*Factory setting*
Geographical zone (apartment)	---- / 1…126	----
Time switch slave (apartment)	---- / 1…126	----
Time switch operation	Autonomous / Slave / Master	Display only

The settings made are also displayed under:
Main menu > Device information > Communication > Heating circuit
The geographical zone from which a value is received and the geographical zone to which a value is sent must be selected.

Geographical zone

Within the geographical zone, the heating circuits forward:

- The room temperature (actual value and setpoint)
- The time switch data
- The room operating mode

If a heating circuit sends data to other rooms, assignment to the respective geographical zone must be correctly set.

Heating circuits with the setting “Room control combination“ = slave (refer to subsection 10.10.3 “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.
Time switch data are sent only if operating line ”Time switch slave (apartment)“ 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 this is the case, no more time switch data are sent via the geographical zone. But the geographical zone is still required for communication with the room unit. The geographical zone must have some other setting value.

Choice of combinations

The following combinations result from the 2 settings:

Setting geographical zone (apartment)	*Setting 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

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 used as a communicating digital room unit. 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 the room unit's Installation Instructions (G1633).

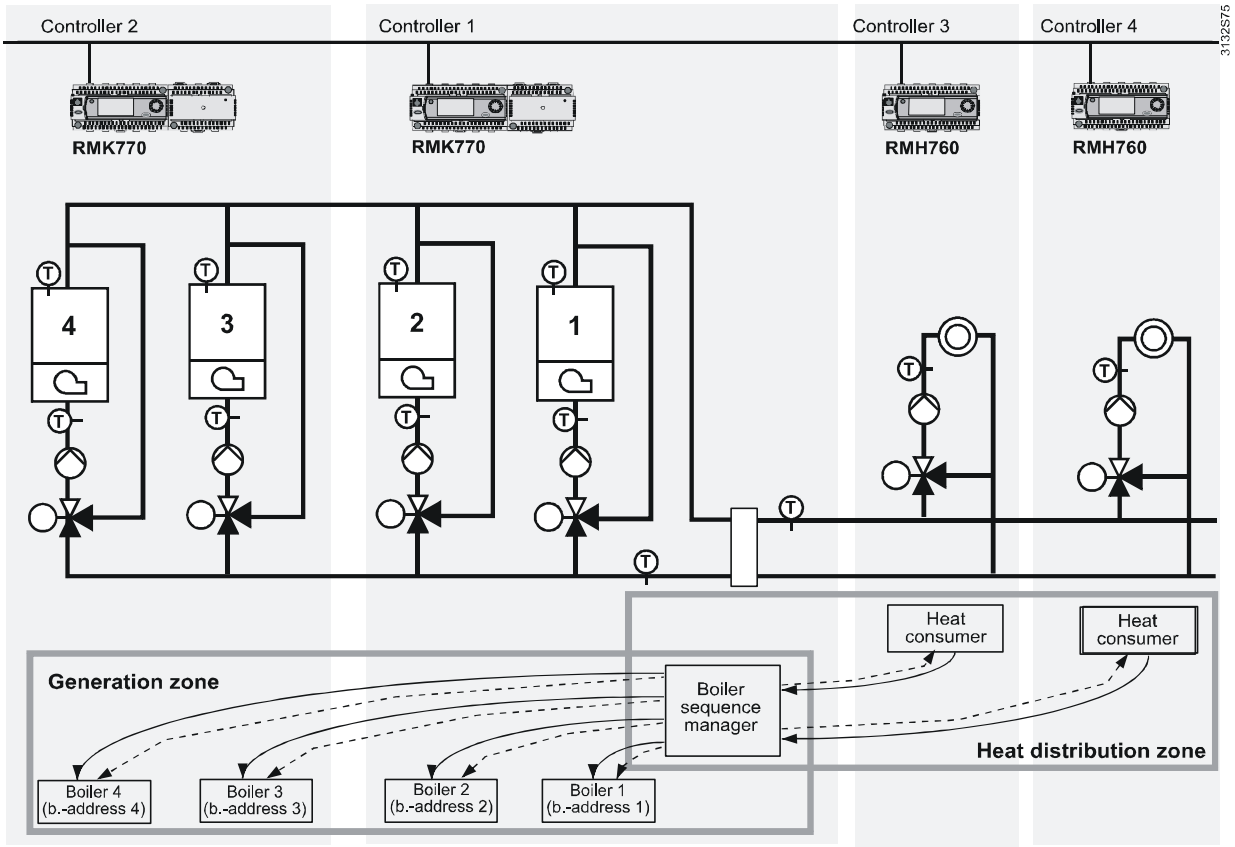
14.4 Heat generation zone and boiler sequence zone

For data exchange between the boiler sequence manager and the individual boilers, the heat generation zone is of importance.
If more than 1 RMK770 is required for the control of the boiler sequence, the same boiler sequence zone must be set on all RMK770 controllers. Typically, boiler sequence zone 1 is selected here.

Main menu > Commissioning > Communication > Generation zones

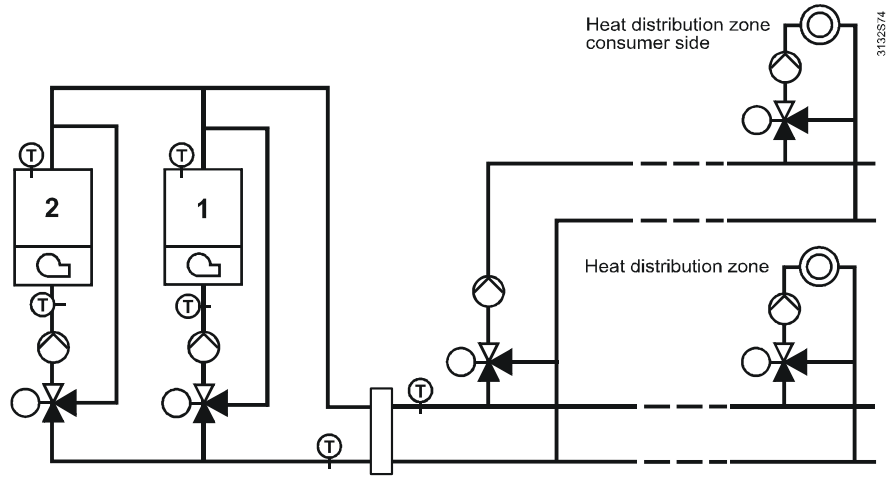
Operating line	*Range*	*Factory setting*
Boiler sequence zone	1…16	1
[Boiler 1] boiler address no	1…31 (RMK 1…6)*	1
[Boiler 2] boiler address no	1…31 (RMK 1…6)*	2
[Boiler 3] boiler address no	1…31 (RMK 1…6)*	3
[Boiler 4] boiler address no	1…31 (RMK 1…6)*	4
[Boiler 5] boiler address no	1…31 (RMK 1…6)*	5
[Boiler 6] boiler address no	1…31 (RMK 1…6)*	6

* The boiler sequence manager in the RMK770 only identifies boiler addresses 1 through 6. For future applications, a value from 1 to 31 can be set



The boiler sequence manager is always in the controller with the main flow sensor.
Usually, boiler 1 is also controlled by the controller with the main flow sensor.
Normally, boiler 1 is assigned boiler address 1, boiler 2 boiler address 2, etc.
In normal situations, no changes are required here.
When, in the above example, boilers 1 and 2 are assigned to the first RMK770, boilers 3 and 4 of the second RMK770 should also be called boilers 3 and 4. Hence, they are automatically given boiler addresses 3 and 4 and appear as boilers 3 and 4 on the info level of the controller with the boiler sequence manager.
If, on the second RMK770, one would have used boilers 1 and 2 and assigned to them boiler address 3 and 4 in Setting > Communication > Generation zone, the RMK770 with the boiler sequence manager would have displayed the boilers as boilers 3 and 4, but they would have been displayed as boilers 1 and 2 on the second RMK770 controller.

14.5 Heat distribution zones



14.5.1 Heat demand and load control

The heat demand and the load control signals are exchanged via the heat distribution zones.

Main menu > Commissioning > Communication > Distribution zones

Operating line	*Range*	*Factory setting*
Heat distribution zone	1…31	1
Heat distr zone consumer side	---- / 1…31	2
Outside temperature zone	---- / 1…31	1

In case of boiler sequencing, the boiler sequence manager receives the heat demand signals.
For this reason, the heat distribution zone must be set on every RMK770 that accommodates a boiler sequence manager.
Since the boiler sequence may be using a primary controller, it must be decided whether the heat demand signals shall be fed to the primary controller or directly to the main header.
According to this differentiation, a “Heat distribution zone“ and a ”Heat distr zone consumer side“ can be defined.
The boiler sequence manager receives the heat demand signals from these 2 heat distribution zones.
The setting whether the possibly existing internal heating circuit in the RMK770 shall be linked to the primary controller or main header is not made on the Communication menu, but on the following menu:

Main menu > Commissioning > Extra configuration > Heating circuit

Operating line	*Range*	*Factory setting*
Heat req heat circuit acting on	Main distributor / Primary controller	Main distributor

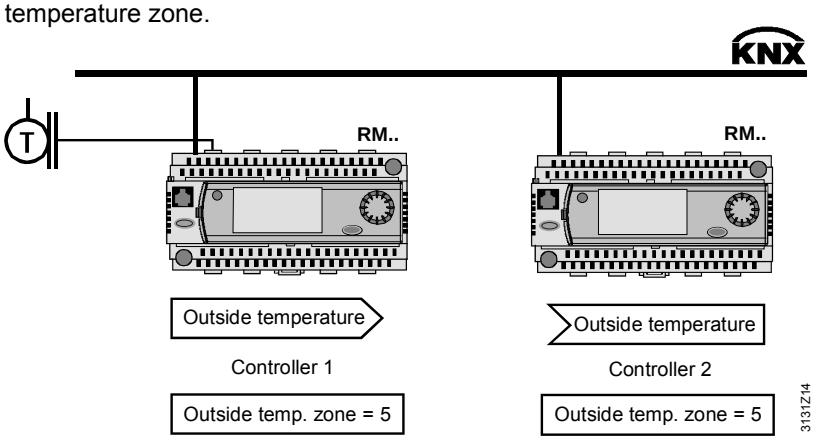
14.5.2 Outside temperature

The outside temperature signals are exchanged via the outside temperature zone.

Main menu > Commissioning > Communication > Distribution zones > Outside temperature zone

Example

If an outside sensor is connected to the controller with outside temperature zone 5, that controller transmits its outside temperature to all controllers that use the same outside temperature zone.



Outside temperature zone

Several outside temperature zones are possible.
When using setting “---“, the controller does not send the outside temperature signal via bus.

14.6 Fault handling

The RMK770 controller has maximum 1 heating circuit and 1 time switch. Index 1 indicates that the fault occurred on this plant.

Bus power supply fault

Number	*Text*	*Effect*
5000	No bus power supply	No bus power supply. Urgent message; must not be acknowledged

Clock time fault

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 1 clock time master present. 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

System time switch fault

Number	*Text*	*Effect*
5101	Syst time switch failure plant 1	Time switch master is missing or cannot be received. Nonurgent message; must not be acknowledged
5102	>1 time switch in plant 1	More than 1 time switch master in the same geographical zone. Nonurgent message; must be acknowledged

Fault in connection with holidays / 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 1 holidays/special day master. Nonurgent message; must be acknowledged

Room master and zone fault in heating circuit 1

Number	*Text*	*Effect*
5401	Room master failure in plant 1	Room master for the room control combination is missing or cannot be received. Nonurgent message; must not be acknowledged
5402	>1 room master [1]	>1 room master for plant 1 in the same geographical zone. Nonurgent message; must be acknowledged

Addressing fault

Number	*Text*	*Effect*
6001	>1 identical device address	More than 1 device with the same device address. Urgent message; must be acknowledged

Boiler addressing fault

Number	*Text*	*Effect*
5512	>1 boiler with address number 1	2 boilers with boiler address 1. Nonurgent message; must be acknowledged
5522	>1 boiler with address number 2	2 boilers with boiler address 2 Nonurgent message; must be acknowledged
5532	>1 boiler with address number 3	2 boilers with boiler address 3. Nonurgent message; must be acknowledged
5542	>1 boiler with address number 4	2 boilers with boiler address 4. Nonurgent message; must be acknowledged
5552	>1 boiler with address number 5	2 boilers with boiler address 5. Nonurgent message; must be acknowledged
5562	>1 boiler with address number 6	2 boilers with boiler address 6. Nonurgent message; must be acknowledged

Boiler sequence fault

Number	*Text*	*Effect*
5591	Failure boiler sequence manager	Nonurgent message; must be acknowledged
5592	>1 boiler sequence manager	Nonurgent message; must be acknowledged

15 Fault tracing support

If a fault is displayed, it is always practical to select the Main menu, operating line ”Faults > Faults current”, and look for any pending fault status messages before starting to rectify a fault. If an extension module is faulty, that fault must be corrected first because it can lead to sub sequential fault status messages.
For a detailed description of the display, acknowledgement and resetting of faults, refer to subsection 13.5.1 “Acknowledgement and reset“.

15.1 Fault code list

The RMK770 controller has maximum 1 heating circuit and 1 time switch. Index 1 indicates that the fault occurred on this plant.

Note

The table below contains the fault number texts with which the controller is supplied. Texts with designations of aggregates, such as [Boiler …], [Primary controller] and [Heating circuit], can be changed on the password level.

Number	*Name (as supplied)*	*For explanation, refer to section …*
10	Outside temp sensor error	10.11
11	>1 outside temperature sensor	10.11
12	Outs sensor simulation active	10.11
50	[HC 1] error flow sensor	10.11
51	[HC 1] error return sensor	10.11
57	Prim controller error flow sensor	9.10
58	Prim controller error ret sensor	9.10
60	Room sensor error plant 1	10.11
61	>2 room sensors in plant 1	10.11
301	[Boiler 1] boiler sensor error	7.15
302	[Boiler 2] boiler sensor error	7.15
303	[Boiler 3] boiler sensor error	7.15
304	[Boiler 4] boiler sensor error	7.15
305	[Boiler 5] boiler sensor error	7.15
306	[Boiler 6] boiler sensor error	7.15
311	[Boiler 1] return sensor error	7.15
312	[Boiler 2] return sensor error	7.15
313	[Boiler 3] return sensor error	7.15
314	[Boiler 4] return sensor error	7.15
315	[Boiler 5] return sensor error	7.15
316	[Boiler 6] return sensor error	7.15
321	[B1] flue gas temp sensor error	7.15
322	[B2] flue gas temp sensor error	7.15
323	[B3] Flue gas temp sensor error	7.15
324	[B4] flue gas temp sensor error	7.15
325	[B5] flue gas temp sensor error	7.15
326	[B6] flue gas temp sensor error	7.15
330	Main flow sensor error	6.4
331	Main return sensor error	6.4
332	[Boiler seq] MBRT sensor error	6.4
333	Consumer return sensor error	6.4
2202	Main contr h’request mod error	6.8
2203	Prim contr h’request mod error	9.10
2300	>1 boiler faulty	6.8
2301	[B1 burner] fault	7.15

Number	*Name (as supplied)*	*For explanation, refer to section …*
2302	[B2 burner] fault	7.15
2303	[B3 burner] fault	7.15
2304	[B4 burner] fault	7.15
2305	[B5 burner] fault	7.15
2306	[B6 burner] fault	7.15
2311	[B1 burner] no checkback signal	7.15
2312	[B2 burner] no checkback signal	7.15
2313	[B3 burner] no checkback signal	7.15
2314	[B4 burner] no checkback signal	7.15
2315	[B5 burner] no checkback signal	7.15
2316	[B6 burner] no checkback signal	7.15
2321	[Boiler 1] water shortage	7.15
2322	[Boiler 2] water shortage	7.15
2323	[Boiler 3] water shortage	7.15
2324	[Boiler 4] water shortage	7.15
2325	[Boiler 5] water shortage	7.15
2326	[Boiler 6] water shortage	7.15
2331	[Boiler 1] overpressure	7.15
2332	[Boiler 2] overpressure	7.15
2333	[Boiler 3] overpressure	7.15
2334	[Boiler 4] overpressure	7.15
2335	[Boiler 5] overpressure	7.15
2336	[Boiler 6] overpressure	7.15
2341	[Boiler 1] underpressure	7.15
2342	[Boiler 2] underpressure	7.15
2343	[Boiler 3] underpressure	7.15
2344	[Boiler 4] underpressure	7.15
2345	[Boiler 5] underpressure	7.15
2346	[Boiler 6] underpressure	7.15
2351	[B1 valve] no checkback signal	7.15
2352	[B2 valve] no checkback signal	7.15
2353	[B3 valve] no checkback signal	7.15
2354	[B4 valve] no checkback signal	7.15
2355	[B5 valve] no checkback signal	7.15
2356	[B6 valve] no checkback signal	7.15
2361	[B1] flue gas overtemperature	7.15
2362	[B2] flue gas overtemperature	7.15
2363	[B3] flue gas overtemperature	7.15
2364	[B4] flue gas overtemperature	7.15
2365	[B5] flue gas overtemperature	7.15
2366	[B6] flue gas overtemperature	7.15
2371	Boiler test operation active	7.15
2391	[Boiler seq] water shortage	6.4
2392	[Boiler sequence] overpressure	6.4
2393	[Boiler sequence] underpressure	6.4
2396	Main flow temp not reached	6.4
2401	[B1 pump] overload	7.15
2402	[B2 pump] overload	7.15
2403	[B3 pump] overload	7.15
2404	[B4 pump] overload	7.15
2405	[B5 pump] overload	7.15
2406	[B6 pump] overload	7.15

Number	*Name (as supplied)*	*For explanation, refer to section …*
2411	[B1 pump] no flow	7.15
2412	[B2 pump] no flow	7.15
2413	[B3 pump] no flow	7.15
2414	[B4 pump] no flow	7.15
2415	[B5 pump] no flow	7.15
2416	[B6 pump] no flow	7.15
2421	[B1 pump B] overload	7.15
2422	[B2 pump B] overload	7.15
2423	[B3 pump B] overload	7.15
2424	[B4 pump B] overload	7.15
2425	[B5 pump B] overload	7.15
2426	[B6 pump B] overload	7.15
2431	[B1 pump B] no flow	7.15
2432	[B2 pump B] no flow	7.15
2433	[B3 pump B] no flow	7.15
2434	[B4 pump B] no flow	7.15
2435	[B5 pump B] no flow	7.15
2436	[B6 pump B] no flow	7.15
2441	[Boiler 1 pump] fault	7.15
2442	[Boiler 2 pump] fault	7.15
2443	[Boiler 3 pump] fault	7.15
2444	[Boiler 4 pump] fault	7.15
2445	[Boiler 5 pump] fault	7.15
2446	[Boiler 6 pump] fault	7.15
2491	[Main pump] overload	6.4, 13.5.3
2492	[Main pump B] overload	6.4, 13.5.3
2493	[Main pump] no flow	6.4
2494	[Main pump B] no flow	6.4
2495	[Main pump] fault	6.4
2501	[System pump] overload	9.10
2502	[System pump B] overload	9.10
2503	[System pump] no flow	9.10
2504	[System pump B] no flow	9.10
2505	[System pump] fault	9.10
2521	[Heat circuit pump] overload	9.10
2522	[Heat circuit pump B] overload	10.11
2523	[Heat circuit pump] no flow	10.11
2524	[Heat circuit pump B] no flow	10.11
2525	[Heating circuit pump] fault	10.11
5000	No bus power supply	14.6
5001	System time failure	14.6
5002	>1 clock time master	14.6
5003	Invalid time of day	14.6
5101	Syst time switch failure plant 1	14.6
5102	>1 time switch in plant 1	14.6
5201	Hol/spec day program failure	14.6
5202	>1 hol/spec day program	14.6
5401	Room master failure in plant 1	14.6
5402	>1 room master [1]	14.6
5512	>1 boiler with address number 1	14.6
5522	>1 boiler with address number 2	14.6

Number	*Name (as supplied)*	*For explanation, refer to section …*
5532	>1 boiler with address number 3	14.6
5542	>1 boiler with address number 4	14.6
5552	>1 boiler with address number 5	14.6
5562	>1 boiler with address number 6	14.6
5591	Failure boiler sequence manager	14.6
5592	>1 boiler sequence manager	14.6
5593	Number of boilers wrong setting	6.8
5594	Invalid lead boiler	6.8
6001	>1 identical device address	14.6
7101	Fault extension module	3.3.6
7102	Fault extension module 2	3.3.6
7103	Fault extension module 3	3.3.6
9000	>1 fault input fault	13.8.1
9001	[Fault input 1] fault	13.8.1
9002	[Fault input 2] fault	13.8.1
9003	[Fault input 3] fault	13.8.1
9004	[Fault input 4] fault	13.8.1
9401	No pulse signal meter 1	11.3.8
9402	No pulse signal meter 2	11.3.8
9403	No pulse signal meter 3	11.3.8
9404	No pulse signal meter 4	11.3.8

15.2 Rectification of faults

Question	*Reply*
E.g., fault status message “[HC 1] error flow sensor“ appears although a sensor is connected.	Check to see if, in addition, fault “Fault extension module“ occurred. This fault can lead to the display of subsequential faults.
When commissioning the plant, the wrong language was selected. How do I find the language I need?	1. Press the ESC button and the OK knob simultaneously. 2. Choose 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 device is completely switched off, “Operation locked, Remote operation” appears. How do I start the device again?	Remote operation (OCI700.1) set the device to commissioning mode, which has locked local operation. If the device is not corrected restarted via remote operation, it maintains this state. Locally, the device can only be restarted by briefly disconnecting the power supply.
The buttons on the QAW740 room unit do not work.	The room operating mode on the controller is overridden by a higher priority.

16 Addendum

16.1 Configuration diagrams

Use

Use of the configuration diagrams is explained in subsection 3.3.5 „Use of configuration diagrams“

16.1.1 Terminal markings

The designations of the signal inputs and outputs and of the assigned connection terminals are structured according to the following pattern:

Example	*Explanation*
N.X3	N = controller RMK770 X3 = universal input
N.D1	N = controller RMK770 D1 = digital input
A9(2).Y1	A9 = type of extension module (2) = 2nd extension module of the same type Y1 = analog output DC 0…10 V
N.Q7	N = controller RMK770 Q7 = relay output

16.1.2 Code letters

Uppercase letters

Physical inputs and outputs are marked with uppercase letters:

Code letter	*Explanation*
N	Boiler sequence controller RMK770
A5	Universal module RMZ785
A7	Universal module RMZ787
A7	Universal module RMZ788
A9	Universal module RMZ789
D	Digital input
X	Universal input
Q…	Switching load (changeover or NO contact)
Y	Analog output DC 0…10 V
3P	3-position output in pairs

Lowercase letters

Internal signals are marked with lowercase code letters:

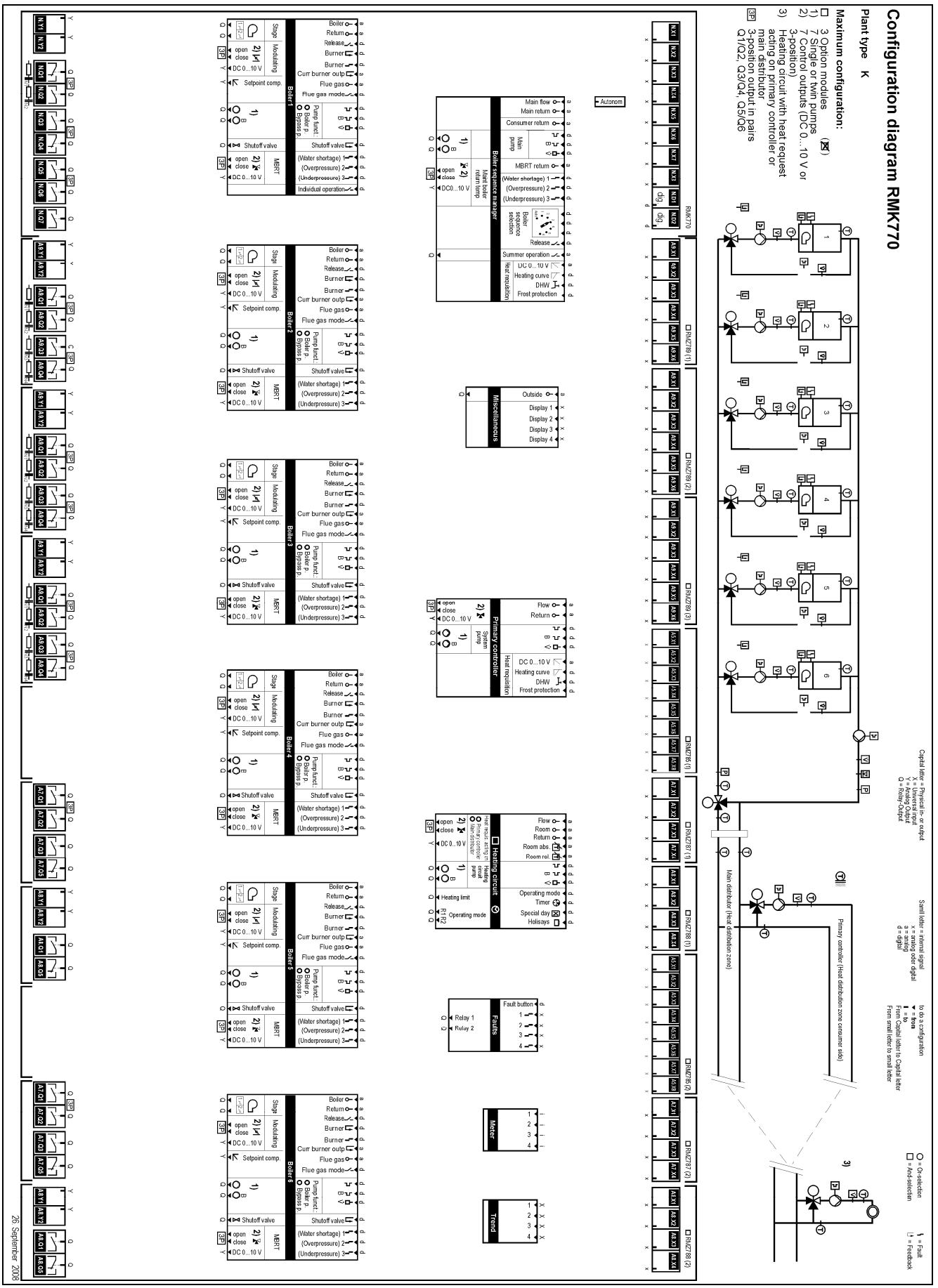
Code letter	*Explanation*
x	Analog or digital
a	Analog
d	Digital
i	Pulse

16.1.3 Configuration choices

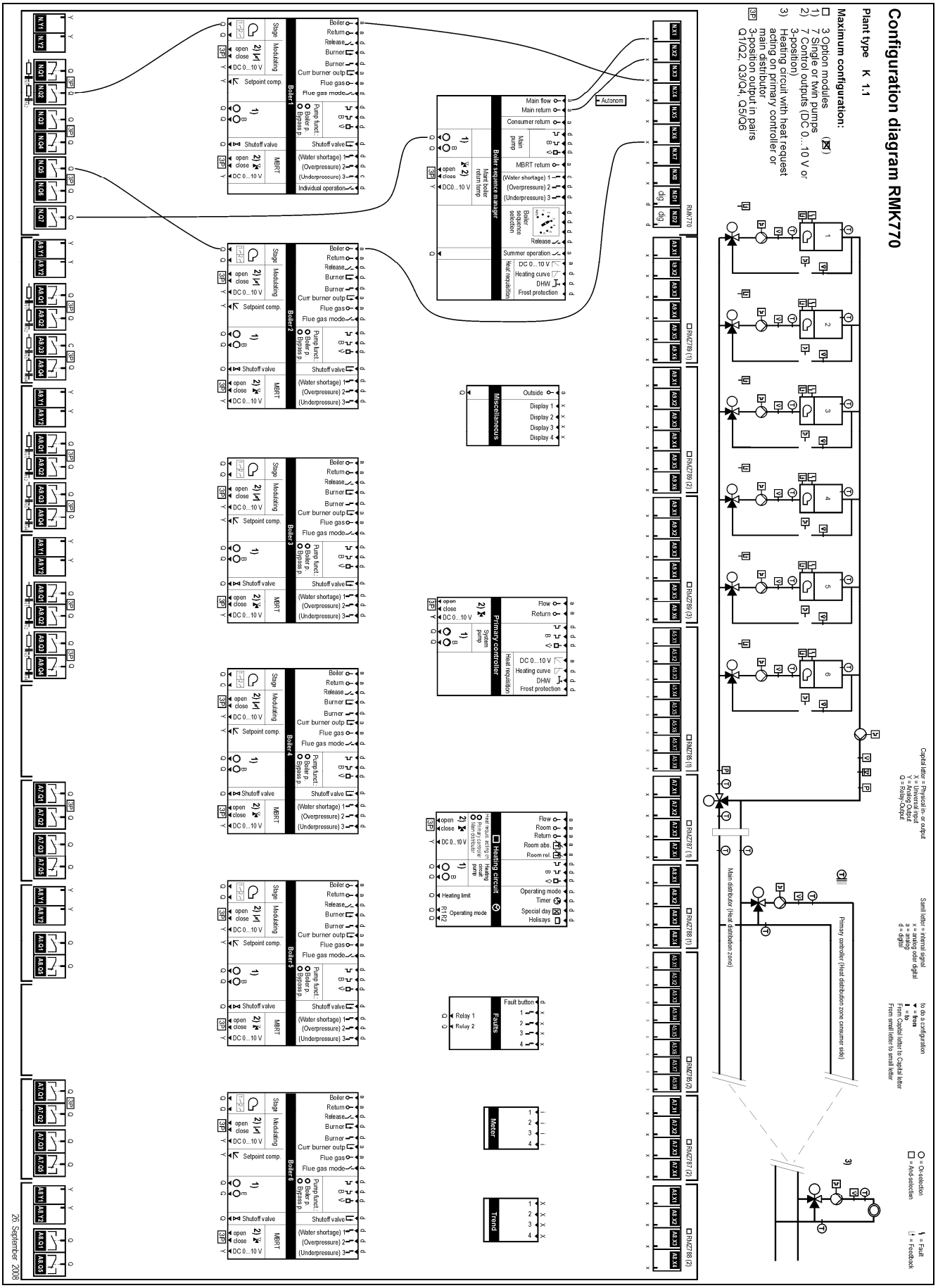
A maximum of 3 extension modules with outputs for 7 single or twin pumps as well as 7 positioning outputs are available. The procedure for the configuration is always as follows:

- from arrow ▼ to line ▌
- from uppercase to uppercase letter
- from lowercase to lowercase letter

16.1.4 Configuration diagram plant type K



16.1.5 Configuration diagram plant type K1.1



16.2 Editable texts

The following list of editable texts shall serve as an aid for engineering and commissioning. The maximum text length is 20 characters.
On the password level, operating texts, such as menu, fault or datapoint texts can be reset as follows:

Main menu > Settings > Texts

Operating line	*Adjustable values / display / remarks*
Reset	No / Yes

Note

The texts of the datapoints “Device name“, “File“ and “Business card line 1…4“ on the Texts menu are not deleted when making a reset.

16.2.1 Boiler sequence manager

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

Datapoint name	*Factory setting*
Fault text	[Boiler seq] water shortage

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

Datapoint name	*Factory setting*
Fault text	[Boiler seq] overpressure

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

Datapoint name	*Factory setting*
Fault text	[Boiler seq] underpressure

16.2.2 Boilers

Main menu > Settings > Boiler 1 (or 2...6)

Datapoint name	*Factory setting*
Boiler 1:	Boiler 1
Boiler 2:	Boiler 2
Boiler 3:	Boiler 3
Boiler 4:	Boiler 4
Boiler 5:	Boiler 5
Boiler 6:	Boiler 6

Main menu > Settings > Boiler 1 (or 2...6) > Fault settings > Fault input 1

Datapoint name	*Factory setting*
Fault text	[Bx] water short

Main menu > Settings > Boiler 1 (or 2...6) > Fault settings > Fault input 2

Datapoint name	*Factory setting*
Fault text	[Bx] overpressure

Main menu > Settings > Boiler 1 (or 2...6) > Fault settings > Fault input 3

Datapoint name	*Factory setting*
Fault text	[Bx] underpressure

Main menu > Settings > Boiler 1 (or 2...6) > Fault settings

Datapoint name	*Factory setting*
[Boiler x] boiler sensor error	[Bx] boil sens err
[Boiler x] return sensor error	[Bx] ret sens err
[Bx] flue gas temp sensor error	[Bx] flue gas s err
[Bx] flue gas overtemperature	[Bx] flue gas o'temp
[Bx burner] fault	[Bx burner] fault
[Bx burner] no checkback signal	[Bx bu] no ch'back sign
[Bx valve] no checkback signal	[Bx va] no ch'back sign
[Bx pump] overload	[Bx P] overload
[Bx pump] no flow	[Bx P] no flow
[Bx pump B] overload	[Bx P B] overload
[Bx pump B] no flow	[Bx P B] no flow
[Boiler x pump] fault	[Bx pump] fault

16.2.3 Primary controller

Main menu > Settings > Primary controller

Datapoint name	*Factory setting*
Primary controller:	Primary controller

Main menu > Settings > Primary controller > Fault settings

Datapoint name	*Factory setting*
Prim controller error flow sensor	Pri ctr err fl sens
Prim controller error return sensor	Pri ctr err ret sens
[System pump] overload	[SP] overload
[System pump B] overload	[SP B] overload
[System pump] no flow	[SP] no flow
[System pump B] no flow	[SP B] no flow
[System pump] fault	[SP] fault

16.2.4 Heating circuit

Main menu > Settings > Heating circuit

Datapoint name	*Factory setting*
Heating circuit:	Heating circuit
Time switch:	Time switch

Main menu > Settings > Heating circuit

Datapoint name	*Factory setting*
[HC 1] error flow sensor	[HC 1] err flow sens
[HC 1] error return sensor	[HC 1] err ret sens
[Heating circuit pump] overload	[HCP] overload
[Heating circuit pump B] overload	[HCP B] overload
[Heating circuit pump] no flow	[HCP] no flow
[Heating circuit pump B] no flow	[HCP B] no flow
[Heating circuit pump] fault	[HCP] fault

16.2.5 Faults

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

Datapoint name	*Factory setting*
Fault text 1:	[Fault input 1] fault
Fault text 2:	[Fault input 2] fault
Fault text 3:	[Fault input 3] fault
Fault text 4:	[Fault input 4] fault

16.2.6 Meters

Main menu > Settings > Data acquisition > Meter 1 (or 2, 3 or 4)

Datapoint name	*Factory setting*
Meter 1:	Meter 1
Meter 2:	Meter 2
Meter 3:	Meter 3
Meter 4:	Meter 4

16.2.7 Devices

Main menu > Settings > Texts

Datapoint name	*Factory setting*
Device name:	Dv name
File name:	File name
Display input 1:	Display input 1
Display input 2:	Display input 2
Display input 3:	Display input 3
Display input 4:	Display input 4
Business card line 1:	Business card line 1
Business card line 2:	Business card line 2
Business card line 3:	Business card line 3
Business card line 4:	Business card line 4

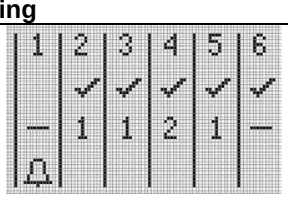
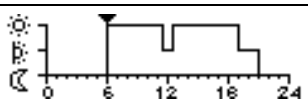
16.2.8 Menu tree

On the software side, all setting and readout values are arranged as data points (operating lines) of the menu tree.
Using the operating elements of the operator unit, every operating line can be selected, displayed or set in accordance with the access right.
The Main menu is subdivided into 18 submenus: The display depends on the products used and the type of plant:

1. Commissioning
2. Boiler sequence manager
3. Boiler 1
4. Boiler 2
5. Boiler 3
6. Boiler 4
7. Boiler 5
8. Boiler 6
9. Primary controller
10. Heating circuit
11. Data acquisition
12. Miscellaneous
13. Time of day/date
14. Faults
15. Settings
16. Device information
17. Data backup

16.3 Info pages

From the start page (Welcome picture), the Info level ℹ (refer to subsection 2.2.3 “Operating levels”) is reached by pressing the INFO button. Here, you find the key plant data listed. No values can be changed here.
The Info level ℹ comprises several pages. The display depends on the type of plant.
When pressing the INFO button, a change is made from one Info page to the next.
Using the OK button, it is possible to scroll through the Info pages in both directions.
The ESC button is used to switch from the Info level ℹ back to the start page.

Boiler sequencing	
Addr no: Release: Burner: Faults:	
Boiler sequence manager	
	State
	Cause
	Summer operation
	Number of avail boil
Boiler sequence manager	
	Main flow temp actual value
	Main flow temp setpoint
	Main return temp actual value
	MBRT return temp actual value
	MBRT return temp minimum
Boiler 1	
	Actual value boiler temperature
	Boiler temperature setpoint
	State
	Cause
Boiler 2...6	
	Actual value boiler temperature
	Boiler temperature setpoint
	State
	Cause
Primary controller	
	Actual value flow temp
	Flow temperature setpoint
	Actual value return temp
	State
	Cause
Heating circuit	
	Preselection
	State
	Cause
Time switch	
	 (Example)

Heating circuit	
	Actual value flow temperature
	Flow temperature setpoint
	State
	Cause
Heating circuit	
	Actual value room temp
	Current room temp setpoint
	Actual value outside temp
Display values	
	Actual value outside temp
	Display input 1
	Display input 2
	Display input 3
	Display input 4
Fault inputs	
	Fault input 1
	Fault input 2
	Fault input 3
	Fault input 4
Device state	
	Fault number
Fault status message bus	
	Fault number
	Device address
Service information	

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