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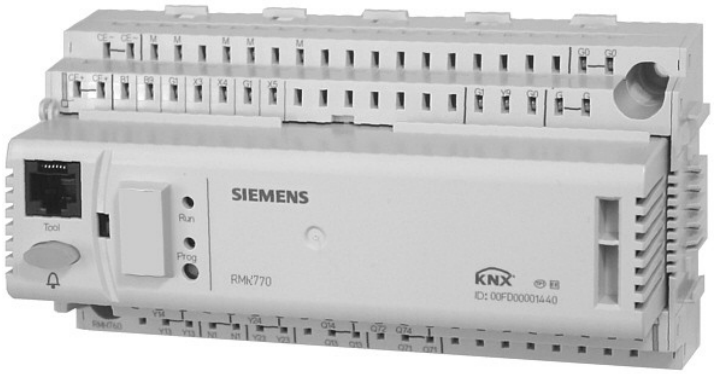

Synco™ 700
Modular Boiler Sequence Controller
RMK770

including extension modules RMZ785, RMZ787, RMZ788 and RMZ789

Basic Documentation

Edition 1.0
Controller series A
CE1P3132en
01.03.2005

Building Technologies
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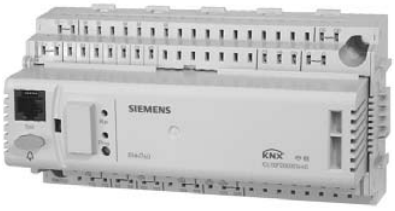
Contents

1 Summary

1.1 Range of units

Type of unit	*Name*	*Type ref.*
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 and 2 analog and 2 relay outputs	**RMZ788**
	Universal module with 6 inputs and 2 analog and 4 relay outputs	**RMZ789**
Module connector	For detached extension modules	**RMZ780**
Operator units	Operator unit, plug-in type	**RMZ790**
	Operator unit, detached	**RMZ791**
Service unit	Service tool	**OCI700.1**



RMK770

RMZ785

RMZ787

RMZ788

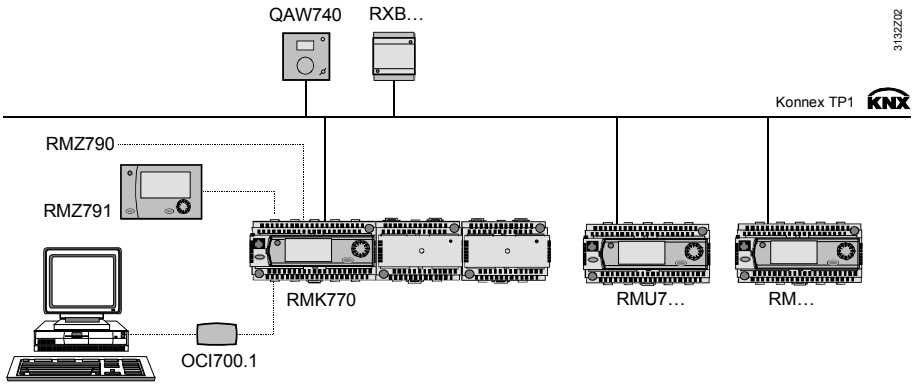
RMZ789

RMZ790

RMZ791

RMZ780

1.2 System topology



1.3 Equipment combinations

Type of unit	*Type reference*	*Data Sheet no.*
Passive sensors	Sensors using a sensing element LG-Ni 1000, 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… QVE81.13	N1186…N1190 N1552 N1592
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 • for 3-position control • for 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 number*
Product range description "HVAC controllers with Konnex interface"	S3110
Data Sheet "Boiler sequence controller RMK770"	N3132
Data Sheet "Universal modules RMZ787, RMZ788, RMZ789"	N3146
Data Sheet "Module connector RMZ780"	N3138
Data Sheet "Konnex bus KNX"	N3127
Data Sheet " Service tool OCI700.1"	N5655
Installation Instructions for RMH760 and RMK770	G3131
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 controllers RMH760-2 and RMK770-2 (en, de , fr, nl)	B3131x2
Operating Instructions for RMH760-3 and RMK770-3 (sv, fi, no, da)	B3131x3
Operating Instructions for RMH760-4 and RMK770-4 (pl, cs, sk, hu)	B3131x4
Operating Instructions for RMH760-5 and RMK770-5 (sr, hr, sl, ro)	B3131x5
Basic Documentation "Communication via Konnex 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

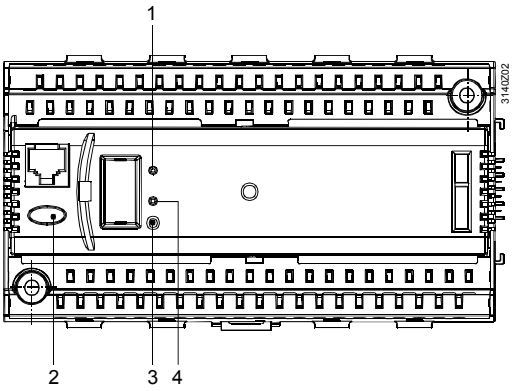
2 Operation

⚠

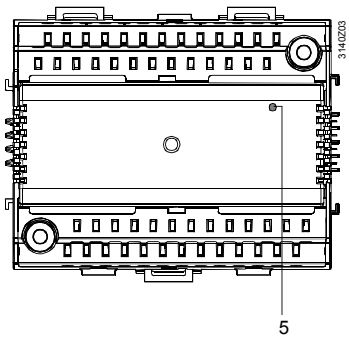
Synco™ 700 devices may only be operated by staff who have been instructed by Siemens Building Technologies or their delegates and whose attention has been drawn to potential risks.

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 flashes:* Fault status message ready for acknowledgement
- *LED lit:* Fault status message still present but not yet reset
- *LED off:* No fault status message present
- *Press button:* 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 flashes:* 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 passed to the operator unit where it is displayed.

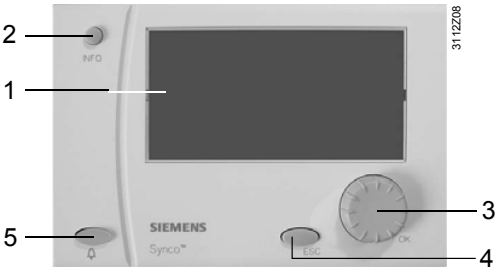
2.2.2 Operating concept

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 clear-text.
The controller has several languages programmed; when commissioning the plant, the required language is to be activated. The Operating Instructions for the enduser are included with the controller; they contain the languages with which the controller is supplied.

Operating elements

Plug-in type operator unit RMZ790



Detached operator unit RMZ791

1 Display

2 INFO button
Function 1: Display of key plant data
Function 2: Display of information about the individual datapoints on the current menu

3 OK select-and-press knob
Turn: Menu option or adjustment of value
Press: Confirm menu line or setting

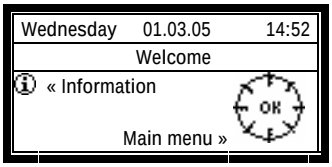
4 ESC button: Going back to the previous menu

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

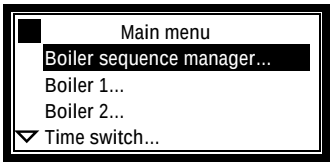
When one of the operating elements is operated, the backlit display will automatically be switched on. If the controller is not operated for 30 minutes, the operator unit will switch itself off and the start page appears.

Display examples

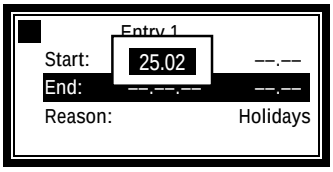
Start display:



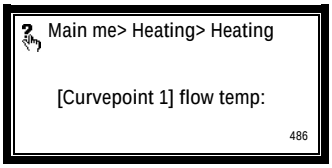
Setting level. Selection of a setting parameter,
e.g. from the main menu of the user level:



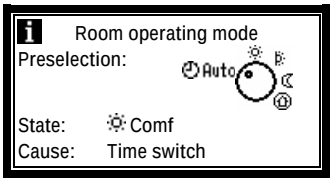
Setting level, pop-up, setting a numerical value:



Setting level, Help picture ”Explanations relating to the selected datapoint”. The text identification number of the menu tree will appear 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:

- Info level
- Setting level
- These 2 levels are always active, independent of which access level is being 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 the OK knob and the ESC button simultaneously; then, select operating line ”Service level” and confirm by pressing the OK knob	
Password level (for the expert)	Press the OK knob and the 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	

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

Switching to another access level

- After a time-out (30 minutes with no 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.

3 Commissioning

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

3.1 Basic concept

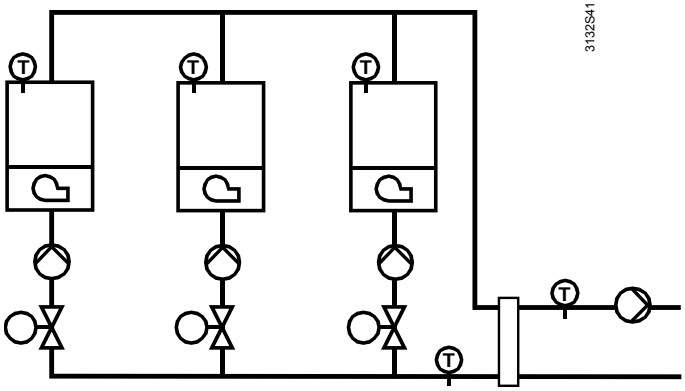
Using the RMK770, boiler sequencing can include up to 6 boilers. When selecting a plant type, boiler sequencing with 2 boilers is predefined. The boiler hydraulics and the type of burner selected with the plant type in the basic configuration always apply to both boilers. Any adaptations in terms of 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 Konnex 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 on the “Extra configuration” menu. For additional boilers, each plant element (burner stages, boiler sensor, etc.) must be configured separately.

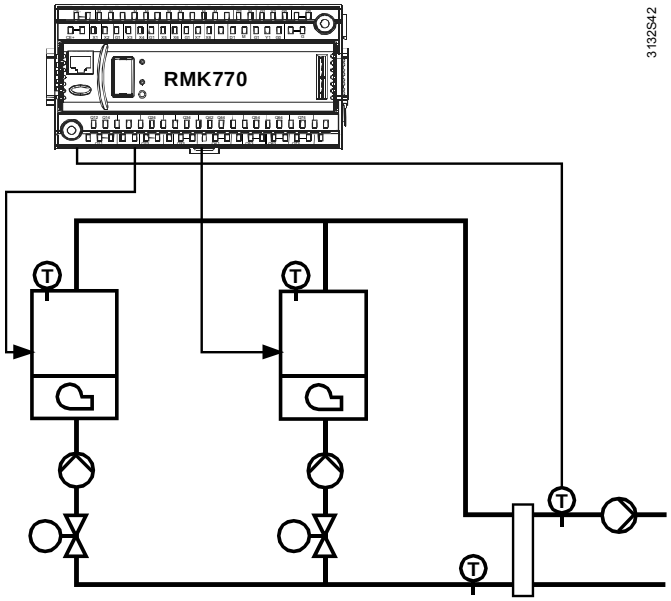
When a second RMK770 is used with the third boiler, the start must be made on the second RMK770 with basic type K. The plant components must now be assigned to boiler 3. On the RMK770 with boilers 1 and 2, the number of boilers must be increased to 3 via the Settings > Boiler sequence manager menu. As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

Example

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



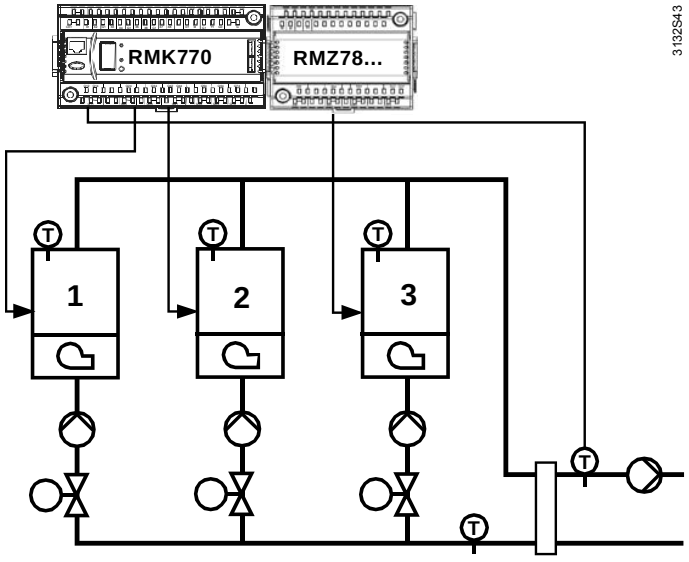
First, select plant type K5.1, because it corresponds to the required boiler hydraulics and the types of burner (refer to subsection 3.3.1 “Plant types”).



There are 2 choices for integrating the third boiler:

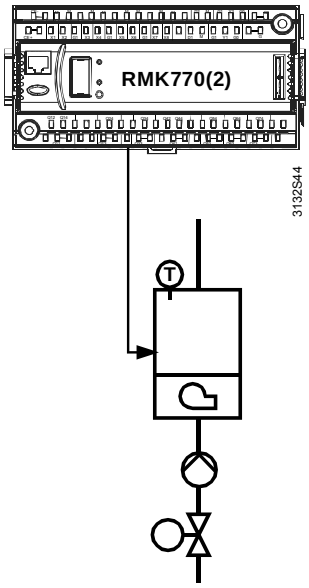
Variant with extension module

Since the RMK770 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 with the third boiler. On that second RMK770, select basic type K and assign boiler 3 the plant components boiler temperature sensor, burner stage 1, boiler pump and shutoff valve in the extra configuration.

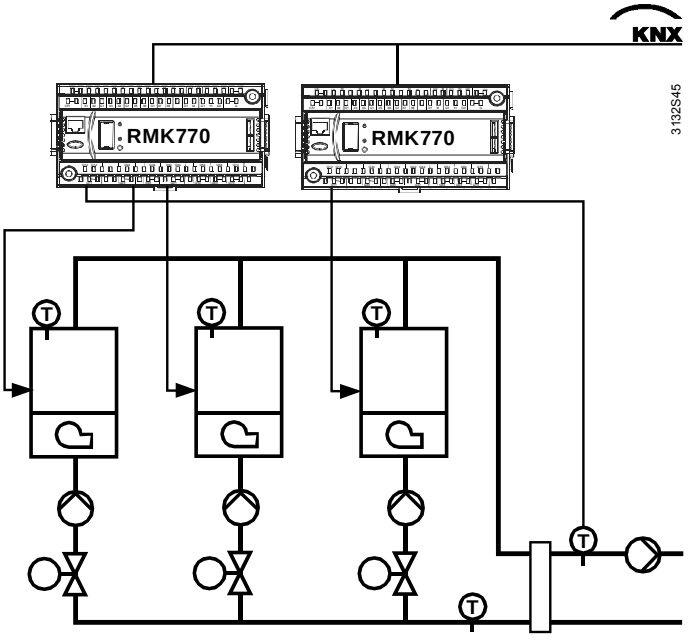


Also, on the first RMK770, the “Number of boilers“ must be set to 3, thus informing the boiler sequence manager that a third boiler must be controlled via bus.

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, that is, 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 will appear.
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 G3131; they are enclosed with the controller.

3.3 Basic configuration

A plant is always 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

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

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 contains 18 plant types. Each plant type can subsequently 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:

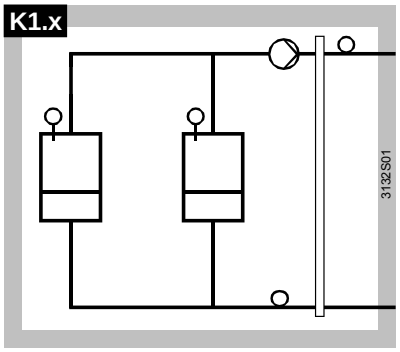
- The first digit defines the type of hydraulic circuit of the boiler sequence
- The second digit defines the type of burner or the type of burner control:
  - Kx.1: 1-stage burner
  - Kx.2: 2-stage burner
  - Kx.3: Modulating burner with 3-position control
- For DC 0…10 V control of a modulating burner, 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”

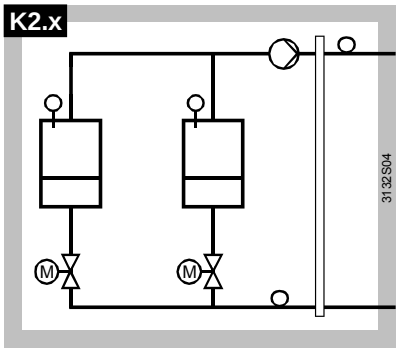
Types of hydraulic circuits

K Basic type K; no preconfigured inputs and outputs

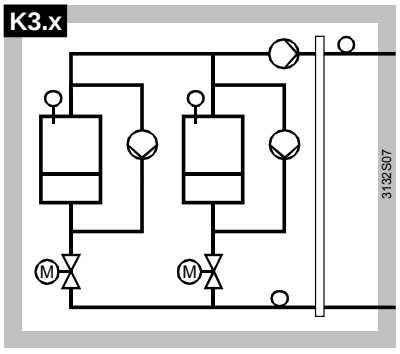
K1.x

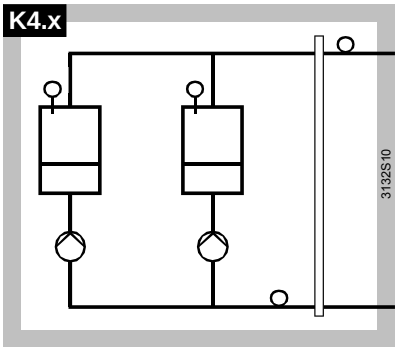


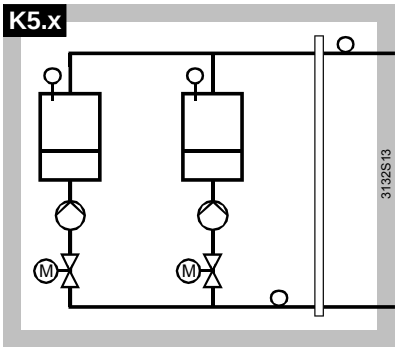
K2.x

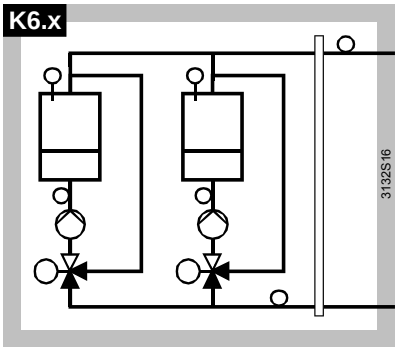


K3.x









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	✓	✓		✓

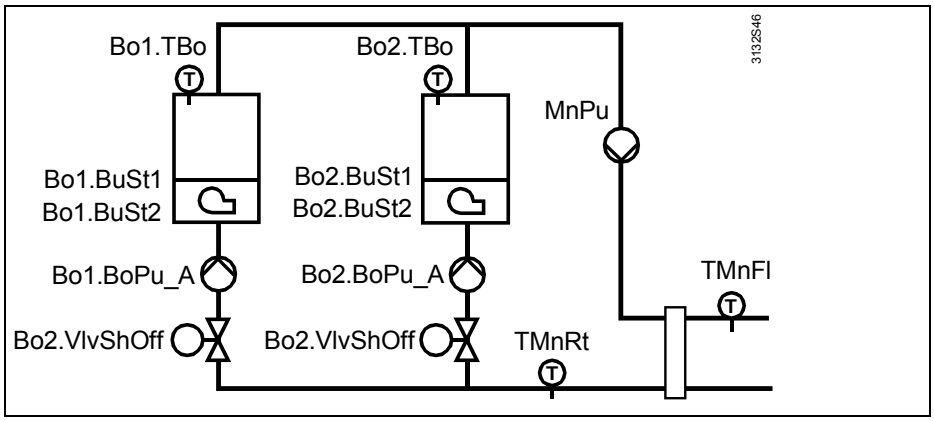
Sensor assignment

With the plant types, the main flow and main return temperature sensors and 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 in the extra configuration.

Assignment of outputs

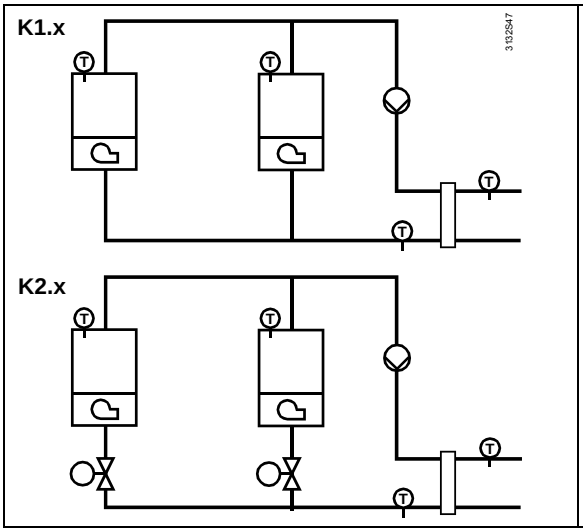
The shutoff valves are always preconfigured to outputs with changeover contacts so that on and off signals are available.
The on and off signals for modulating burners or for the mixing valve of the boiler return temperature are preconfigured to outputs that can be used with RC units to ensure suppression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

The table below gives a summary of the plant types including 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

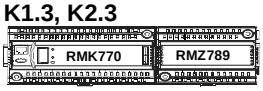
Plant types
K1.x and K2.x



K1.1, K1.2, K2.1, K2.2

RMK770

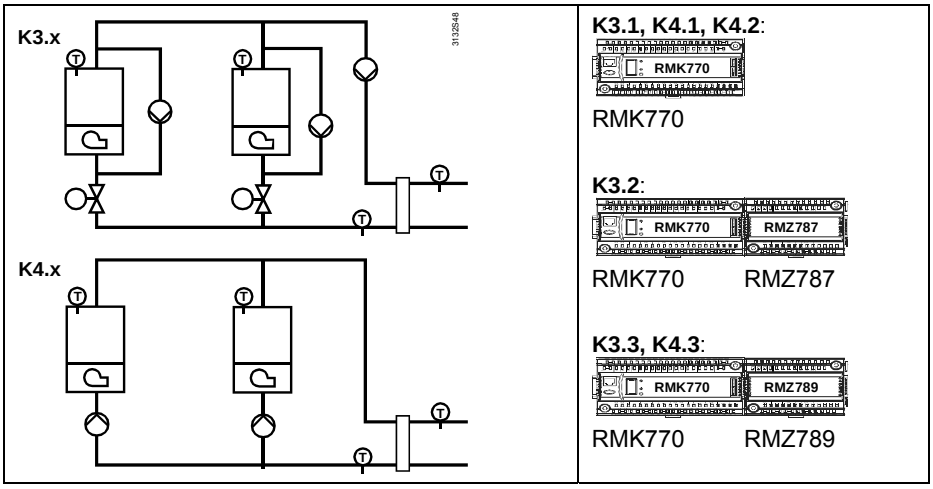
K1.3, K2.3



RMK770 RMZ789

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

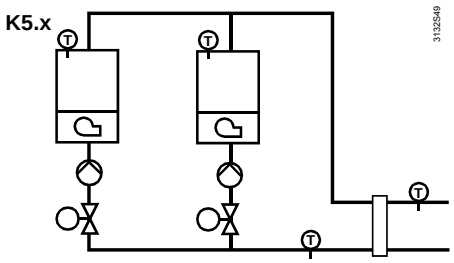
Plant types
K3.x and K4.x



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

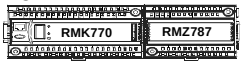
Plant type K5.x



K5.1:

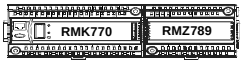
RMK770

K5.2:



RMK770 RMZ787

K5.3:



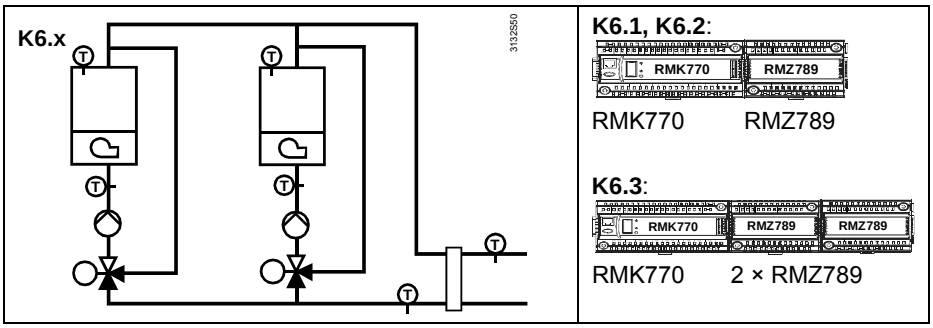
RMK770 1 × RMZ789

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



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

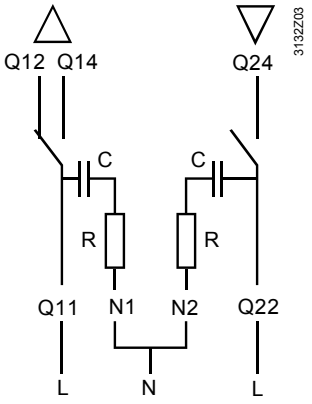
When controlling a shutoff valve, an on / off signal is usually required. For that purpose, a number of relays with changeover contacts are available.
In the case of the RMK770 and RMZ789, these are the outputs Q1 and Q4; in the case of the RMZ787 and RMZ788, output Q5.

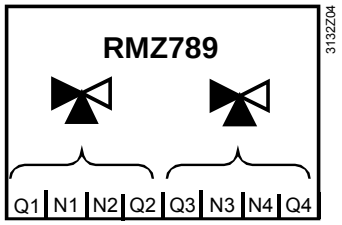
Terminals for 3-position control

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

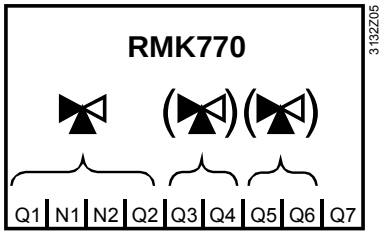
Outputs with RC units

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 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.

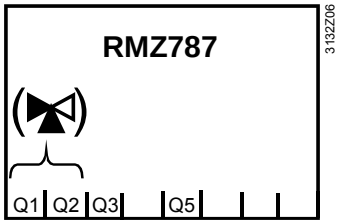


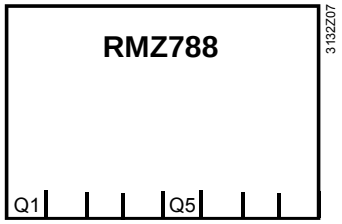


When terminals N1 and N2 or N3 and N4 of the extension module are interconnected and wired to N, the RC unit for outputs Q1/Q2 or Q3/Q4 is activated.



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	*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 on the operator unit.

3.3.4 Maximum configuration

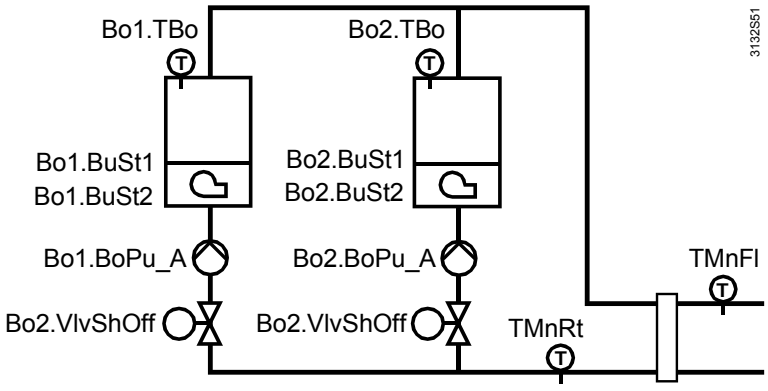
The configuration diagram in the Addendum gives an overview of the maximum number of function blocks that can be configured.

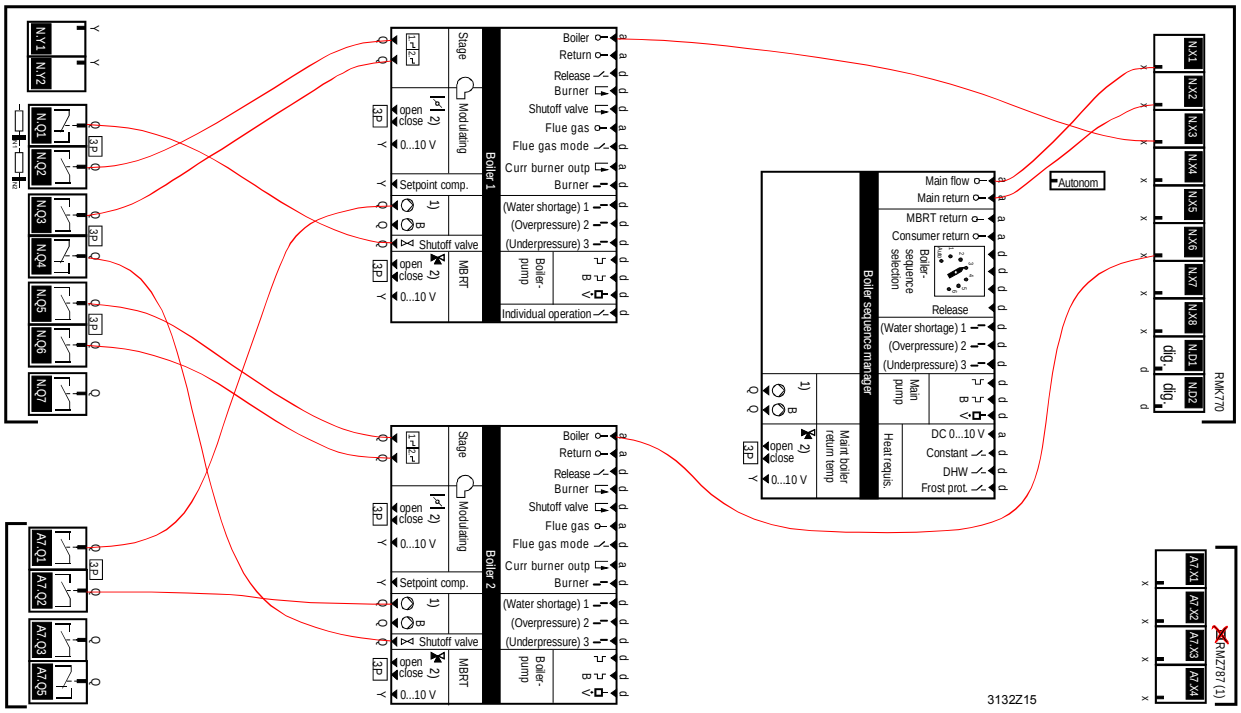
Quantity	*Function block*
1	Boiler sequence manager
6	Boiler
7	Output modulating (3-position or DC 0…10 V)
7	Pump block (for single or twin pumps)
1	Miscellaneous
1	Primary controller
1	Heating circuit
1	Faults

3.3.5 Use of configuration diagrams

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

Plant type K5.2





Function blocks

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

- 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.

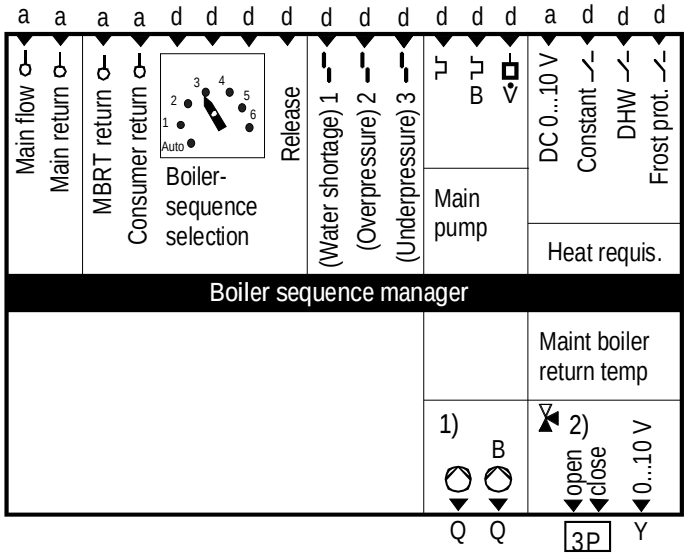
On function block “Boiler 1“, the boiler temperature sensor is configured to terminal N.X3. The burner is preconfigured to outputs N.Q2 and N.Q3, the boiler pump to A7.Q1, and the shutoff valve to the relay with changeover contact N.Q1.

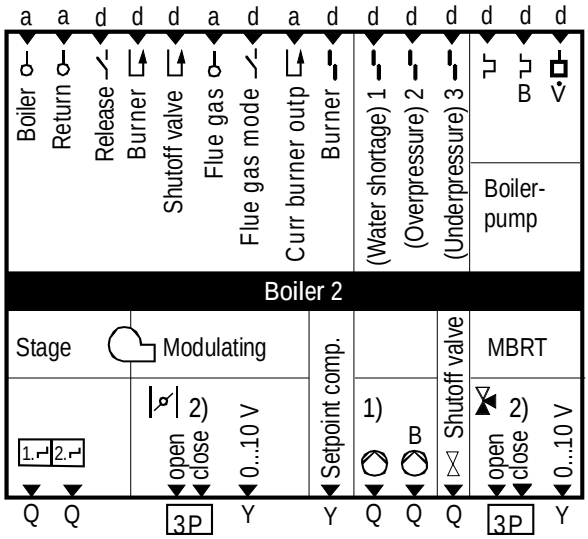
For boiler 2 – analogously – N.X6 is preconfigured for the boiler temperature sensor, N.Q5 and N.Q6 for the 2-stage burner, N.Q4 for the shutoff valve, and A7.Q2 for the boiler pump.

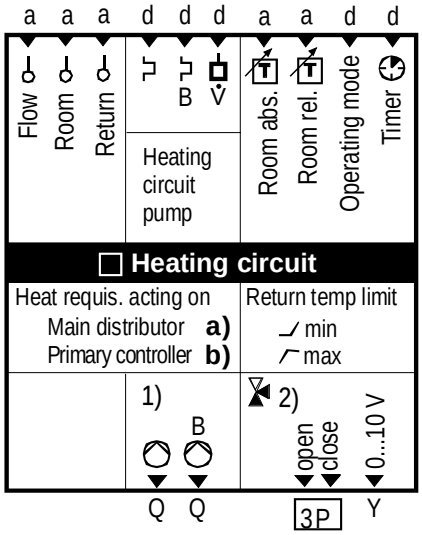
This can be checked on Extra configuration > Boiler 1 (or **b**oiler 2) > Inputs (or **o**utputs).

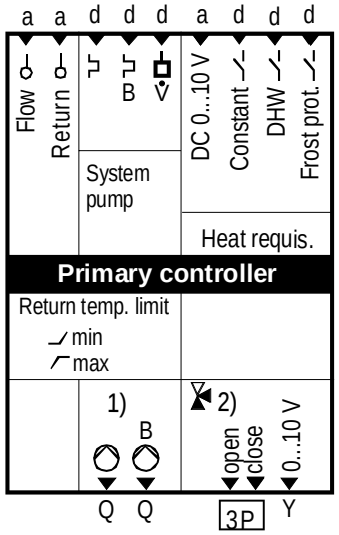
It is possible to reconfigure or remove preconfigured inputs and outputs. If, for example, the second burner stage is removed from boiler 1 (---in place of N.Q3), the burner of boiler 1 becomes a 1-stage burner.

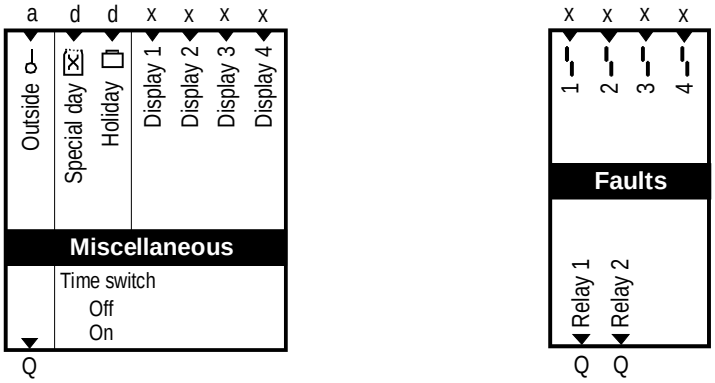
Several function blocks can be activated in the extra configuration.





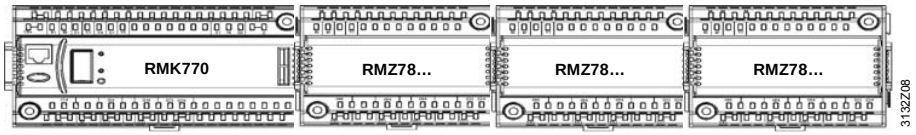






For more detailed information about these function blocks, refer to the following subsections.

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 correspond to the setting 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 per type

A maximum of 3 extension modules per controller can be used. 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 modules can be connected to each 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

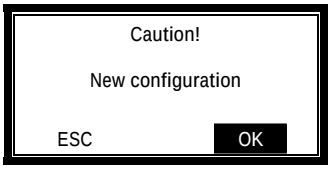
Then, at position 2, module RMZ787 is selected.

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”).

Error 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” will be delivered. In the case of an incorrectly configured extension module, some other fault status message may also be displayed because that consequential fault has the higher priority than fault status message 7101. It is therefore of advantage to have all 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 flash. 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”).
When configuring an input or output, the relevant function block will automatically be activated.
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 inputs 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 will be 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 temperature 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…*	---

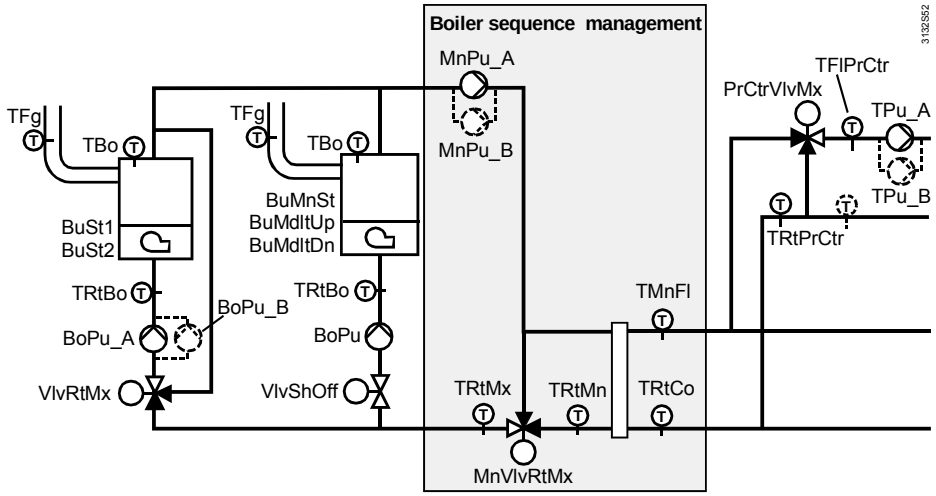
* Here, the free outputs are available for selection

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”.

By making an assignment to an input or output terminal, the relevant plant components will be activated.

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

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

* 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)

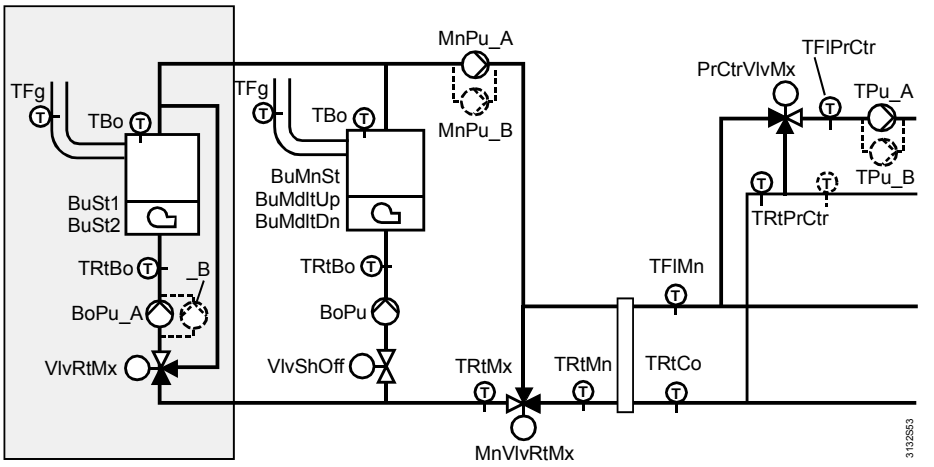
Common main pump B if the common main pump is a twin pump.

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		BoPu_A
Boiler pump		BoPu_B
Shutoff valve		VlvShOff
Maint boiler return temp 3-pos		VlvRtMx
Maint boiler return temp mod		VlVRtMx

* Here, the free inputs are available for selection

Boiler sensor

The boiler temperature sensor is used as a control sensor for the boiler temperature setpoint. The sensor is mandatory if maximum limitation of the boiler temperature is required.

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

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

Boiler pump A

Boiler pump

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

Shutoff valve (VlvShOff)

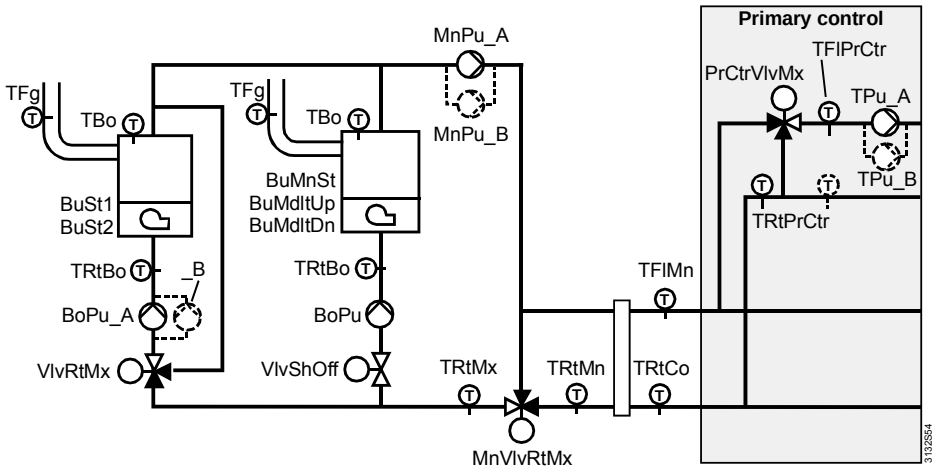
Shutoff valve

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 temperature 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*
System pump	RMK770…, RMZ7…*	TPu_A
System pump B		TPu_B
Mixing valve 3-pos		PrCtrVlvMx
Mixing valve modulating		PrCtrVlvMx

* Here, the free inputs 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)

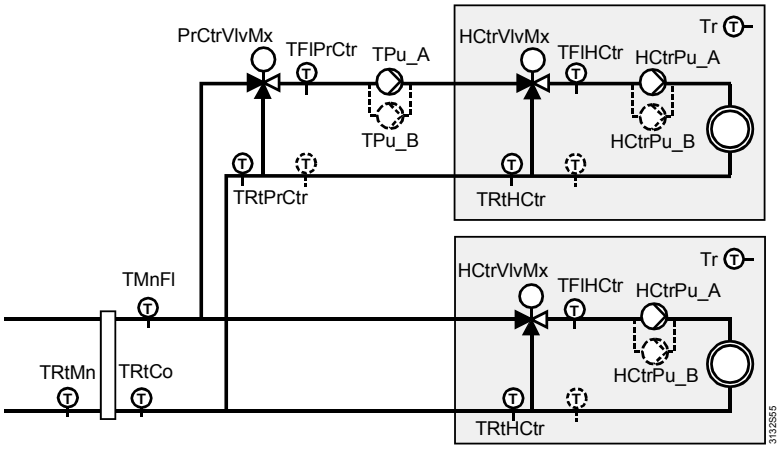
System pump A (the menu item does not show designation A)

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*
Heating circuit	Active / Inactive	Inactive

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		TRtHCtr

* Here, the free inputs are available for selection

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

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

* Here, the free inputs 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. In that case, setting “Heating circuit active / inactive“ is of no importance.

Real heating circuit

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

Heat requisition Heating circuit

This setting defines whether the heating circuit is “connected” directly to the main distributor or after the primary controller.

Flow sensor (TFlPrCtr)

Flow temperature sensor

Room sensor (Tr)

Room temperature sensor

Return sensor (TRtPrCtr)

Return temperature sensor

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)

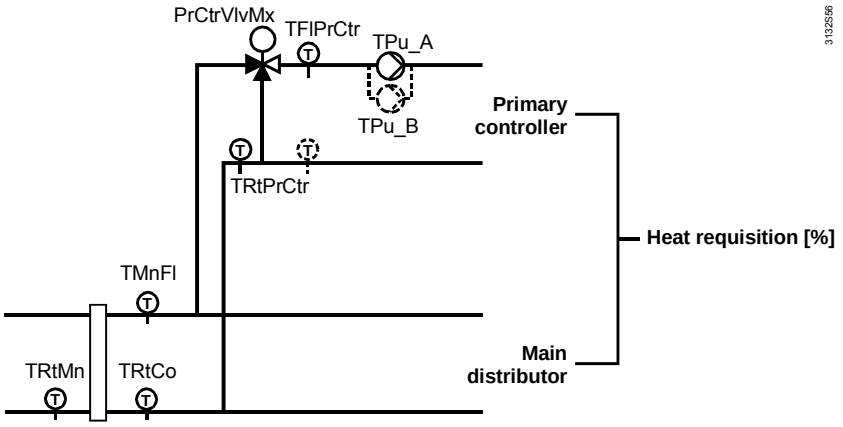
3-position or modulating mixing valve for the heating circuit

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

3.4.5 Heat requisition

Main menu > Commissioning > Extra configuration > Heat requisition [%]

Operating line	*Range*	*Factory setting*
Heat requisition [%] acting on	Main distributor / Primary controller	Main distributor



In place of heat requisition from a heating circuit, a heat requisition can also be made by an air handling plant (e.g. RMU7…) or individual room temperature control (e.g. RXB…). This heat requisition is not made in the form of an absolute temperature request but as a percentage. The conversion from % to °C is made by a heat demand transformer.

Setting “Heat requisition [%] acting on“ determines whether the heat demand of the demand transformer is considered by the heat demand calculation of the boiler sequence either directly via the main distributor or the primary controller.

3.4.6 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…	
Special day input		
Holiday input		
Display input 1	RMK770…, RMZ7…	
Display input 2		
Display input 3		
Display input 4		

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.

Holiday input

Digital input for activating the “Holidays” function.

Display input 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 > Miscellaneous

Operating line	*Range*	*Factory setting*
Input identifier	°C / % / g/kg / KJ/kg / W/m2 / m/s / bar / mbar / Pa / ppm / Universal 000.0 / Universal 0000 / Digital	°C

For resolution, type of sensor, etc., refer to subsection 3.4.8 “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…	

Time switch

Main menu > Commissioning > Extra configuration > Miscellaneous

Operating line	*Range*	*Factory setting*
Time switch	On / Off	Off

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 11 “Function block miscellaneous”.

3.4.7 Faults

Main menu > Commissioning > Extra configuration > Faults > Inputs

Operating line	*Range*	*Name*
Fault input 1	RMK770…, RMZ7…	
Fault input 2	RMK770…, RMZ7…	
Fault input 3	RMK770…, RMZ7…	
Fault input 4	RMK770…, RMZ7…	

Main menu > Commissioning > Extra configuration > Faults > Outputs

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

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

3.4.8 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 Ni 1000 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-Ni 1000 sensing elements have a measuring range of −50…−250 °C
- Passive temperature signals delivered by 2 x LG-Ni 1000 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 > ...

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 > RMK770.X...

Operating line	*Range*	*Factory setting*
Correction	−3.0…+3.0 K	0 K

Error 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

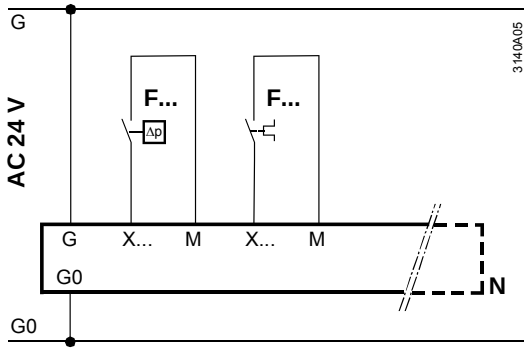
Normal position

The normal position can be predefined for each digital input.

Setting

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

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

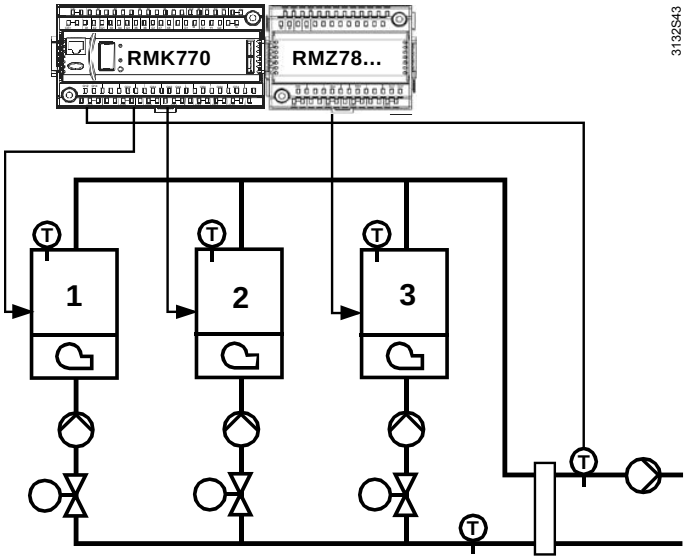


Error handling

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. But there may also be other reasons to have the plant controlled by several RMK770.
In that case, one of the RMK770 will assume the function of boiler master. And only in that RMK770 is function block “Boiler sequence manager” activated. That 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, 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 Konnex bus. It must be activated via the “Communication” menu. For more detailed information, refer to chapter 13 “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-Ni 1000 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

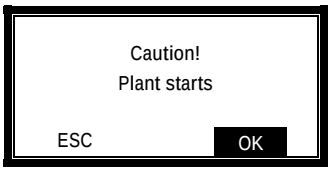
Main menu > Commissioning > Wiring test > Boiler 1 > Outputs

Operating line	*Positions*
Boiler pump	Off / On

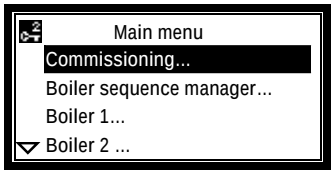
3.7 Concluding commissioning

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	Important: Caution! New configuration
Save	Important: 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 informations > 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 informations > 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”.

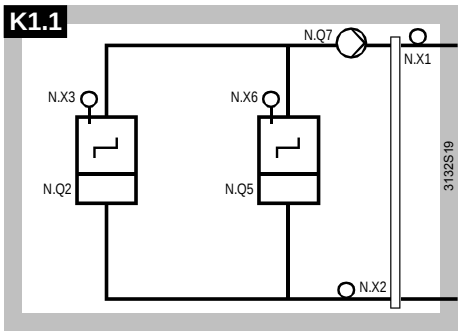
Resetting the marking

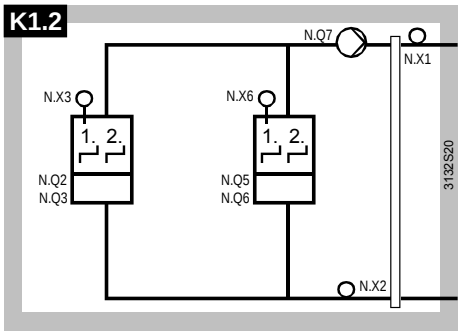
The asterisk will be deleted and the line “Plant type adapted” shows the value as “No” if on the “Basic configuration” menu, the old or a new standard application is loaded for the plant type. A new configuration is made based on the selected application.

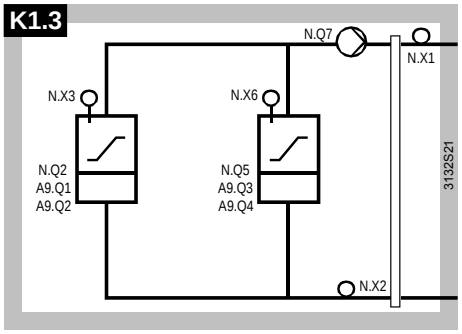
3.12 Plant types and default terminal assignments

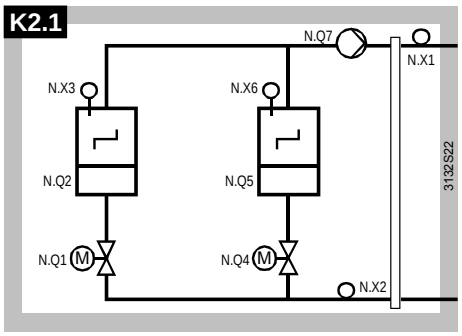
Note

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

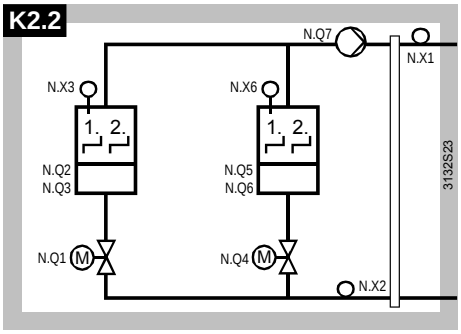




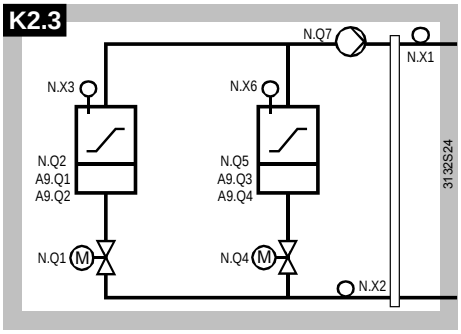




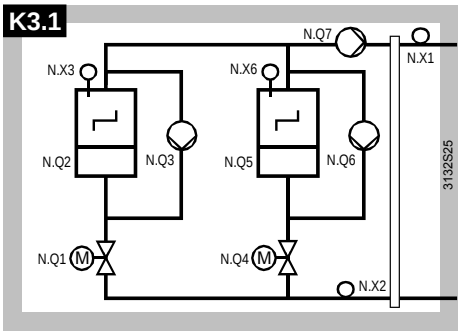
K2.2



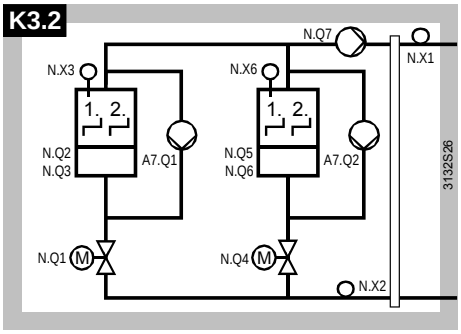
K2.3



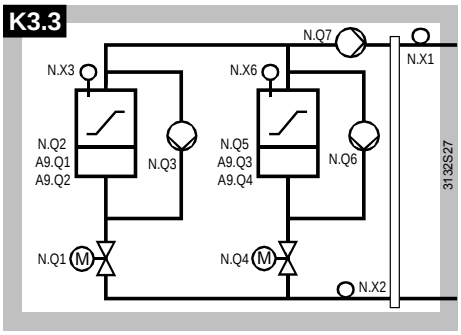
K3.1

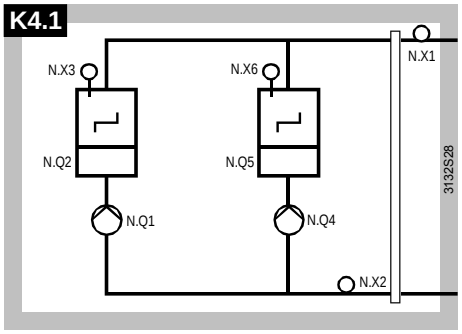


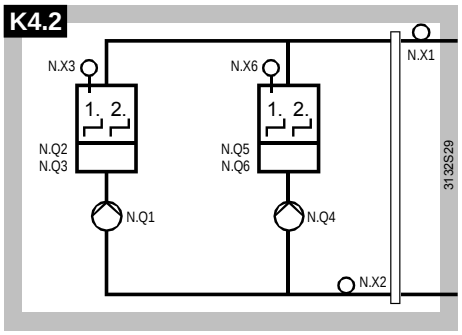
K3.2

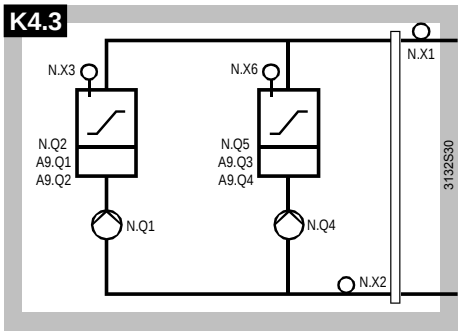


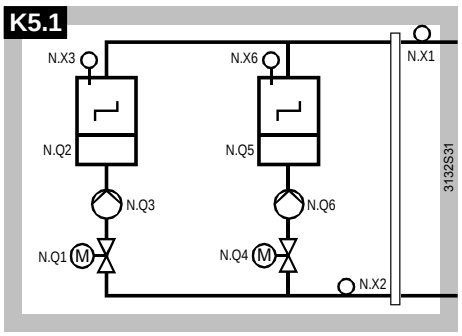
K3.3

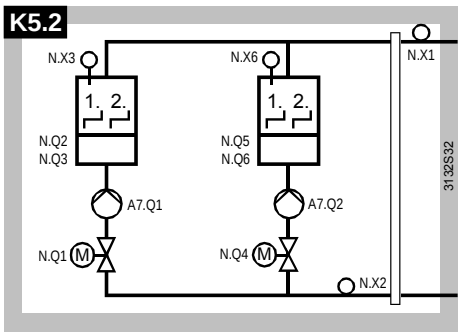


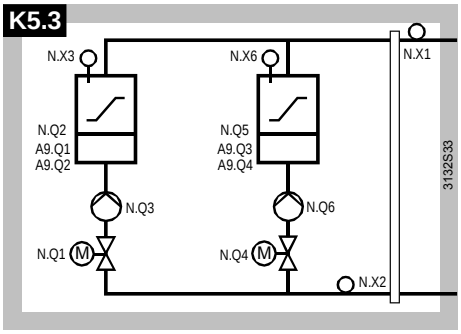


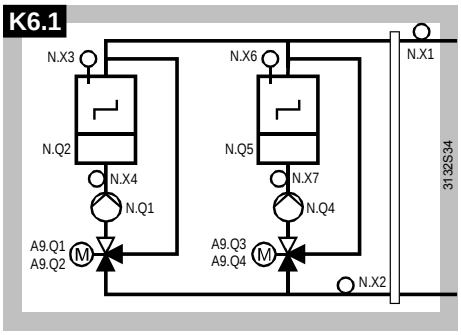


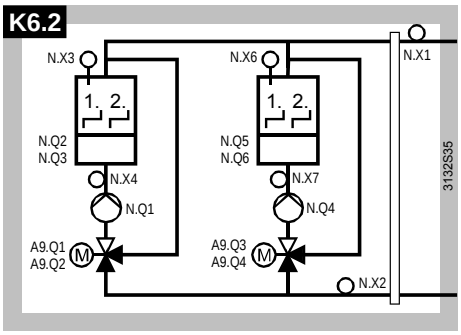


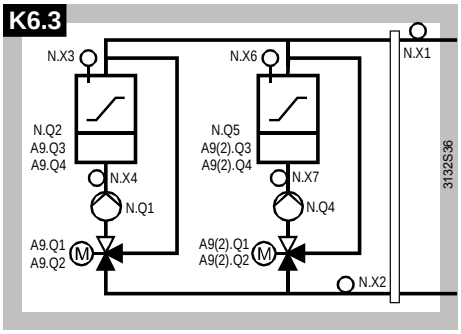












Explanation of the terminal markings used:

= 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 from summertime to wintertime, ensure that on the first Sunday after that date the time of day will change from 02:00 (wintertime) to 03:00 (summertime), and from 03:00 (summertime) to 02:00 (wintertime).
If both dates are set to coincide, summer-/wintertime changeover will be inactive.

Setting

Main menu > Time of day / Date

Operating line	*Range*	*Factory setting*
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)

Setting

Commissioning > Communication > Basic settings >

Operating line	*Range*	*Factory setting*
Clock time operation	Autonomous / Slave / Master	Autonomous

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:

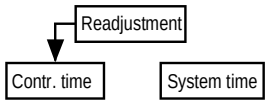
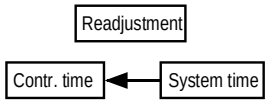
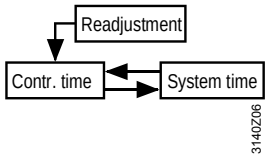
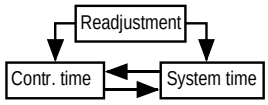
- No (clock time slave with no facility for setting the system time)
- Yes (clock time slave with facility for setting the system time)

Setting

Commissioning > Communication > Basic settings

Operating line	*Range*	*Factory setting*
Remote setting clock slave	Yes / No	Yes

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 will be delivered.

Recommendation

The plant should always be operated in a synchronized manner.

4.1.3 Error handling

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

Fault status messages

Number	*Text*	*Effect*

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

Type	*Language 1*	*Language 2*	*Language 3*	*Language 4*
RMK770-1	German	French	Italian	Spanish
RMK770-2	German	English	French	Dutch
RMK770-3	Swedish	Finnish	Norwegian	Danish
RMK770-4	Polish	Czech	Slowakian	Hungarian
RMK770-5	Serbian	Croatian	Slovenish	Romanian

Setting

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

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

* Available in 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 on 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	Free text, 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	A…Z	

Here, text with a maximum of 20 characters can be entered. This designation will then be 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 ...

Operating line	*Range*	*Factory setting*
Fault text	Free text, max. 20 characters	Aux 1
Fault text		Aux 2
Fault text		Aux 3
Fault text		Aux 4

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		
Business card line 2		
Business card line 3		
Business card line 4		

5 General functions, fundamentals

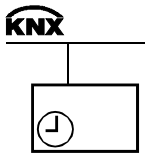
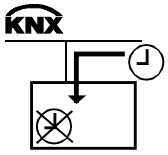
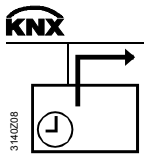
5.1 Time switch

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 Operating Instructions B3131.

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 controller can be used.

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 in this controller is not active. The time switch acting is the external time switch acting in the geographical zone set on this controller as the time switch receiving zone. The external time switch must be set as the time switch master.	
Master	The time switch in this controller is active. The time switch also acts on all other controllers where the time switch is switched off (time switch slave) and which have the geographical zone of this controller set as the time switch receiving zone.	

Main menu > Commissioning > Communication > Room Heating circuit

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

5.1.2 Time switch for external controllers on the bus

The time switch can also be provided to external controllers on the bus.
If the RMK770 is not connected to a heating circuit, the time switch will automatically be hidden. But if required, this time switch can be used for external controllers on the bus (e.g. for RXB… room controllers).
For that purpose, the hidden time switch must be activated.

Configuration

Main menu > Commissioning > Extra configuration > Miscellaneous

Operating line	*Range*	*Remarks*
Time switch	On / Off	Activation of time switch

5.1.3 Entering the 24-hour program for space heating

For space heating, a specific 24-hour program can be selected for every day.

Space heating

Main menu > Time switch

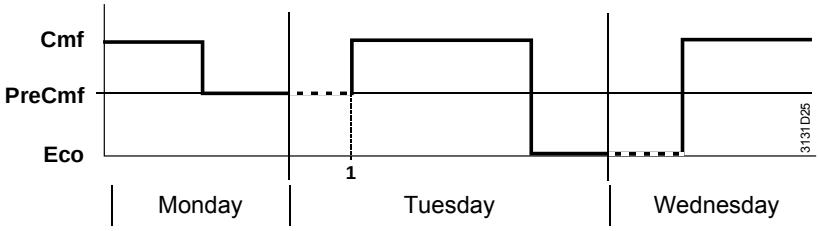
Operating line		*Factory setting*
Monday through Sunday	Comfort / Precomfort / Economy	06:00 Comfort 22:00 Economy
Special day	Comfort / Precomfort / Economy	06:00 Comfort 22:00 Economy

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

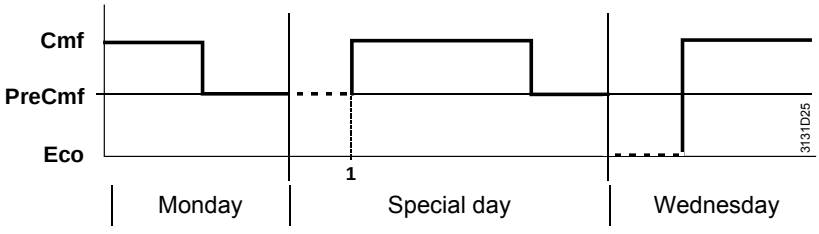
For each day, a maximum of 6 entries can be made in the 24-hour program.
For an entry, following must be entered:

- 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 will be 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.

5.1.4 Error 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 will be 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

If the controller expects a time switch signal via bus and the signal is not sent, a fault status message "System time switch failure" will be delivered. It is ready set to Comfort mode.

Fault status messages

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

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 Operating Instructions B3131.
For each RMK770, a holidays/special days program is available. Separate settings make it possible to select the operating mode that shall apply to both the heating circuits and DHW heating during holidays.

Note on Holidays/special days

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

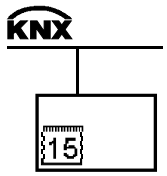
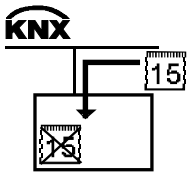
Note on DHW heating

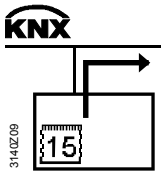
The RMK770 does not provide DHW heating, but DHW signals from the Konnex bus can have an impact.

5.2.1 Communication

If the controller is connected to other controllers via bus, the holidays/special days 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 days program only acts locally on this controller. The holidays/special days program has no impact on the holidays/special day zone entered under communication.	
Slave	The holidays/special days program in this controller is not active. The program acting is the external holidays/special days program that has the same holidays/special day zone set. The external holidays/special days program must be set as the master holidays/special days program	

Entry	*Effect*	*Diagram*
Master	The holidays/special days program in this controller is active. The holidays/special days program also acts on all other controllers where the holidays/special days program is switched off (slave) and which lie in the same holidays/special days zone.	

Main menu > Commissioning > Communication > Holidays/special days

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

For more detailed information about the setting regarding the communication of holidays/special days, refer to chapter 13 “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

It is possible to enter whether, during the holiday period, Economy or Protection mode shall be used. For DHW heating, operating modes Auto, Normal, Reduced and Protection are available.

Setting

Main menu > Holidays/special days

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

If the controller is connected to other controllers via communication and if it is defined as a master, the operating mode selected on it applies to all controllers in the same holidays/special day zone.
If DHW heating lies in the same holidays/special day zone, the operating mode selected under “DHW operating mode holidays” will apply during the holiday period.

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 days 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 day)

Setting

Main menu > 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 will be resumed. During this transition period, it can occur that optimum start control (e.g. boost heating) cannot be started in due time. It is therefore recommended to bring the end of the holiday period somewhat forward, 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 > Miscellaneous > 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 only active 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 will become active. This program is maintained until the input becomes inactive. Then, the normal 7-day program will be resumed.

Holidays

The digital input enables the plant to be 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 will be resumed.

Priority

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

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

Note

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

5.2.6 Error handling

Only one master may be set per holidays/special days zone. If several controllers are set as masters, fault status message “>1 holidays/special days program” will be delivered”. The fault is sent by the controller that receives 2 appropriate signals.
If the controller expects a holidays/special days signal from the bus and the signal is not sent, a fault status message ">1 holidays/special days program" will be delivered.
The operating modes of the 7-day program are used, without giving consideration to the holidays/special days 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 days 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 freezups, 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 requisition. 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

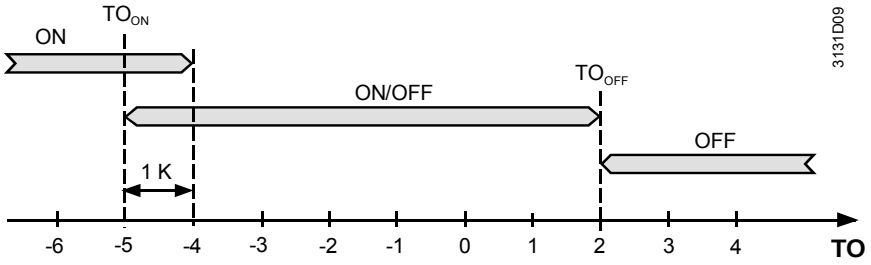
Main menu > Settings > Heating circuit > Limitations

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 will continue to operate with a constant backup value of 0 °C outside temperature.

5.4 Pump overrun and mixing valve overrun

For all pumps 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 “old” 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 will then apply to all pumps and valves connected to the RMK770.
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 and twin pumps”).
The running time for the pumps and actuators need not be set. It is always 30 seconds.
If several pumps are used, they will be kicked one after the other. After the end of a kick, the next pump will be kicked after an interval of 30 seconds.
The valve kick does not act on the shutoff valves.

5.6 Heat demand and load control

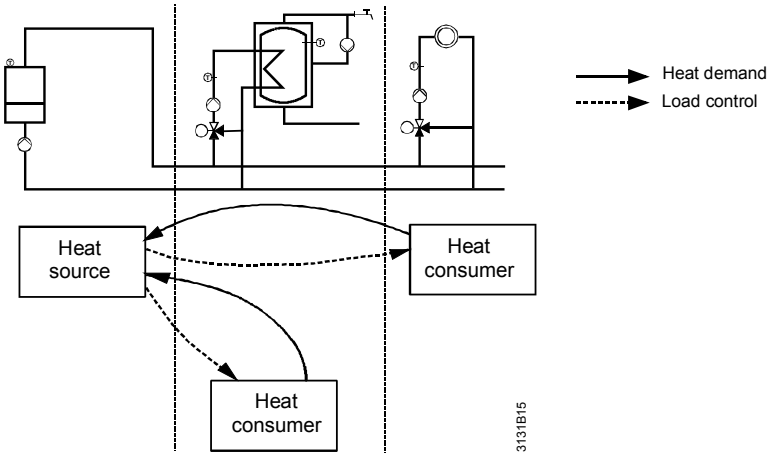
5.6.1 Heat demand

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 accept 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 requisitions”).
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.

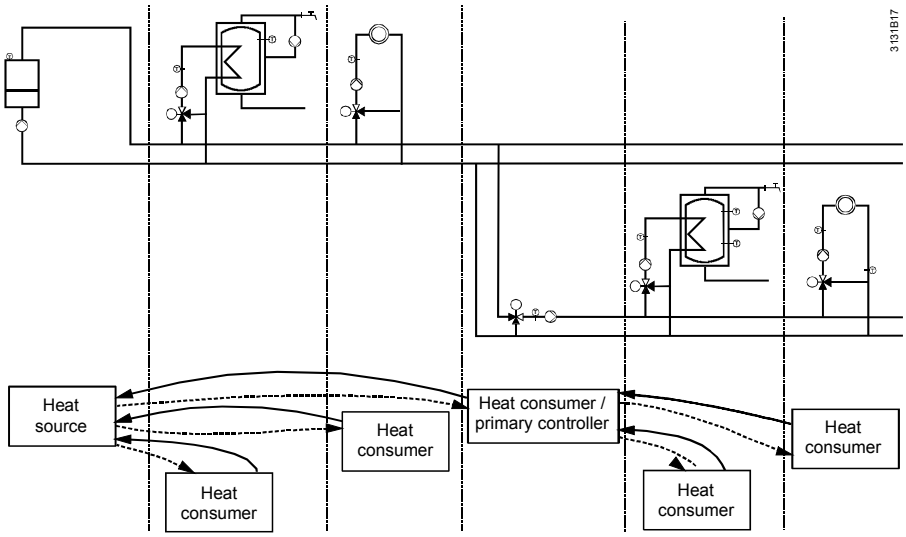
Examples

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 requisition will therefore be 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 will be 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 > Controller 1

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 will be ignored
100 %	Locking signal will be adopted 1-to-1
200 %	Locking signal will be doubled

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

Setting note

If the heat consumer responds too 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 will be ignored, even if it is greater.
Generally, the function of absolute DHW priority in combination with heating circuits does not pose any problems; nevertheless, the correct plant function must always be kept in mind.

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 > Controller 1

Operating line	*Range*	*Factory setting*
Setp boost mixing valve	0…50 K	10 K
Actuator run time	1…600 s	120 s
P-band Xp	1…100 K	48 K
Integral action time Tn	0…600 s	10 s

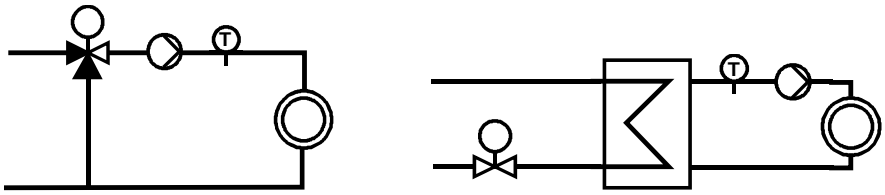
To enable a mixing circuit to control its flow temperature to the setpoint, it requires a higher flow temperature on the inlet side. This elevated temperature can be adjusted separately for each mixing circuit.
In the case of maintained boiler return temperature with mixing valve, this elevated temperature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

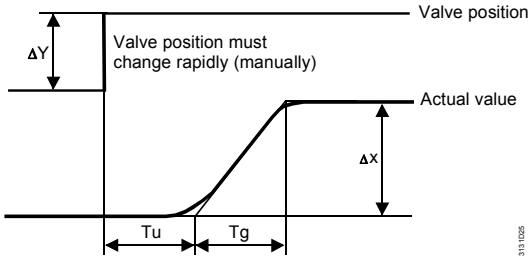
With the help of the P-band (Xp) and the integral action time (Tn), the mixing valve algorithm can be ideally adapted to the relevant controlled system.
The controller is supplied with the control parameters set to values suited for the majority of controlled systems (typically flow temperature control 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 will increase 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 × Δx / Δy × 100 % ˜ 2 × Tu / Tg × Ksmax
Integral action time Tn = 3 × Tu

Example

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

P-band Xp = 2 × 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

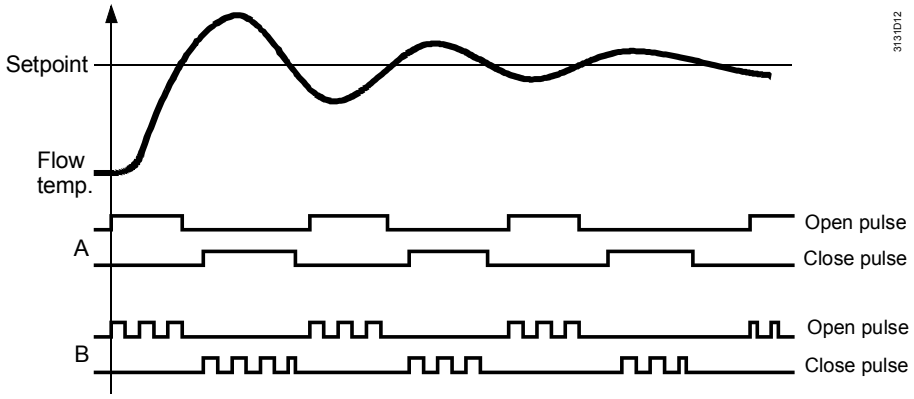
To obtain a reliable step response, it is important during the measurement to keep the temperature upstream of the valve and the return temperature (mixing) as constant as possible.

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:

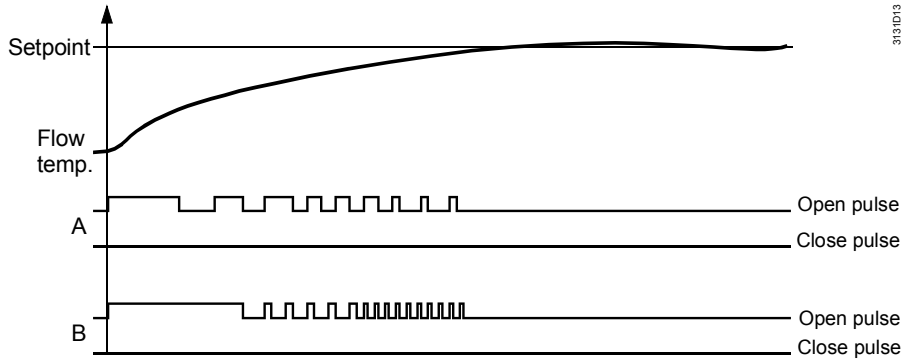
The flow temperature fluctuates about the setpoint



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 will be readjusted by 100 %.

Example

With a P-band of 40 K and a setpoint change of 5 K, the valve will be readjusted by 5 / 40 = 12.5 %. 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 will respond less intensely to the same control deviation. With a P-band of 60 K, for example, the actuator will only take 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 will respond more slowly.

5.7.3 Control signal

Electrothermal actuators

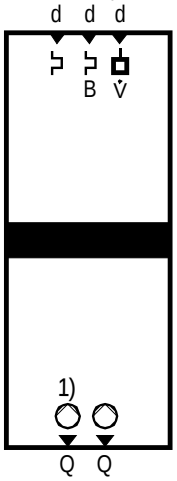
Since the control algorithm uses a stroke model which does not provide control at 0 % and 100 % respectively, the use of electrothermal actuators is no longer possible as this was the case with the RVL47…

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 will immediately be stopped.

5.8 Pump control and twin pumps

Every pump (main pump, boiler pump, system pump, heating circuit pump) can be monitored with a flow switch.
Also, every pump 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 will show 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

5.8.1 Changeover logic

Run priority

For pump changeover, there are 3 choices available:

- Automatic changeover once a week; should the working pump become faulty, changeover to the second pump will take place.
  When switching on the next time, the pump that starts 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 will take place. After rectification of the fault, changeover back to pump A will take place
- Pump B is always the working pump.
  In the event of fault, changeover to pump A will take place. After rectification of the fault, changeover back to pump B will take 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.

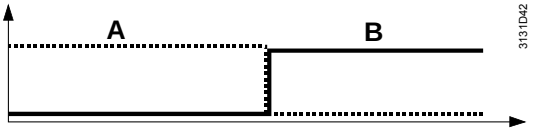
Changeover period

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

- With no interruption
- With overlapping
- With interruption

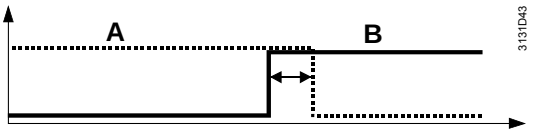
No changeover delay

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



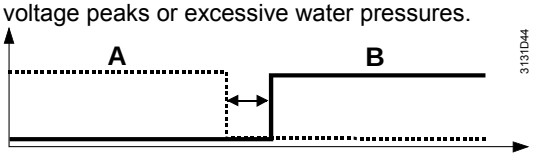
Changeover with negative delay

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

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

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

Delayed changeover also acts with the pump kick.

5.8.2 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 will take place.
In any case, a fault status message will be delivered. This message must be acknowledged, but no reset is required.
If both inputs signal a fault, a reset must be made.

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

The behavior in the event of a pump fault depends on the type of function block.
If a twin pump is used, the fault behavior of the relevant block becomes active only if both pumps fail.

If the boiler pump becomes faulty, the boiler is considered faulty, and a backup boiler will be released.
If the main pump becomes faulty, the entire boiler sequence is considered faulty, and all boilers will be shut down.
If a heating circuit pump or system pump becomes faulty (primary controller), the plant continues to operate.

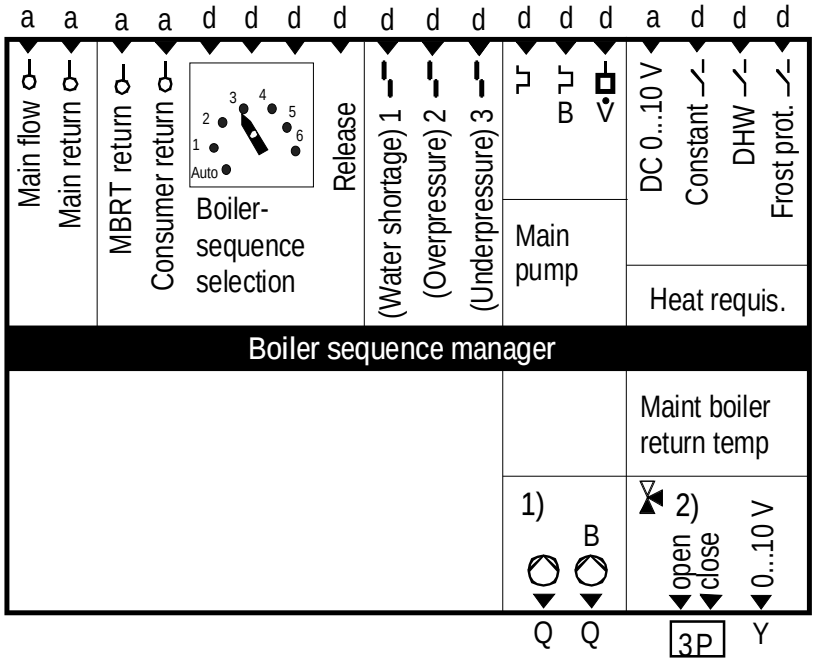
Fault status messages, using the example of the boiler twin pump

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 14 “Fault tracing support”.

6 Boiler sequence management

6.1 Function block overview

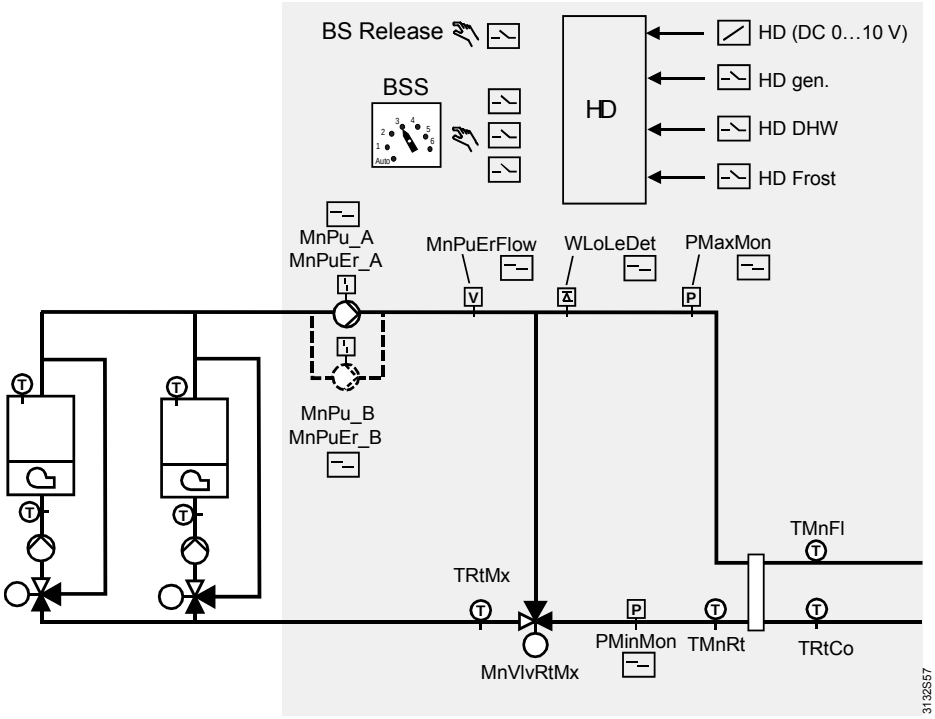


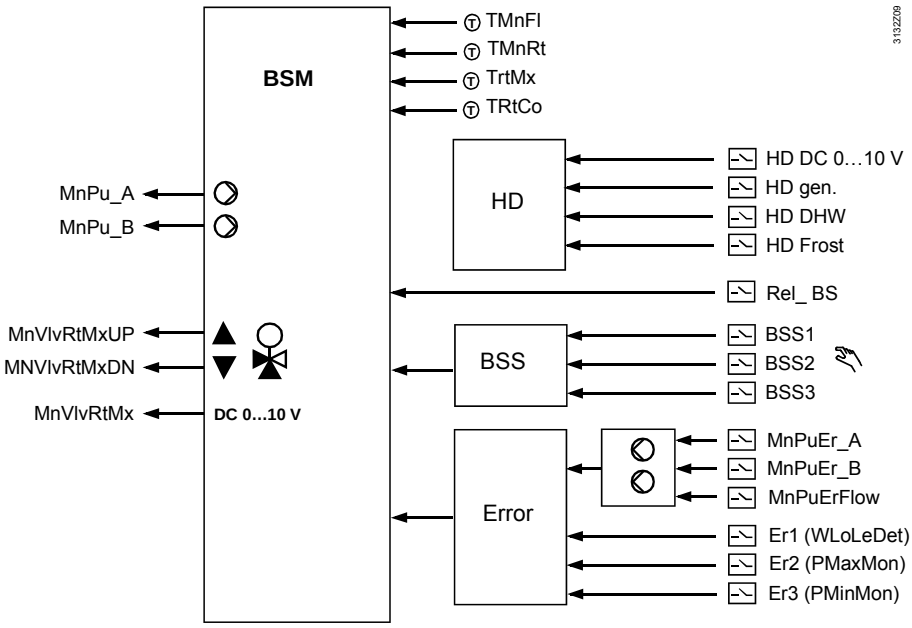
Inputs

TMnFl	Main flow temperature sensor
TMnRt	Main return temperature sensor
TRtMx	Return sensor MBRT
TRtCo	Return sensor consumers
HD 0…10V	Heat requisition modulating
HD gen.	Heat requisition constant
HD DHW	Heat requisition DHW
HD Frost	Heat requisition frost protection
Release BS	Boiler sequence release input
BSS1	Boiler sequence selector 1
BSS2	Boiler sequence selector 2
BSS3	Boiler sequence selector 3
MnPuEr_A	Error main pump A
MnPuEr_B	Error main pump B
MnPuErFlow	Error flow main pump
Er1 (WLoLeDet)	Fault input 1 (water shortage protection)
Er2 (PMaxMon)	Fault input 2 (maximum pressure sensor)
Er3 (PMinMon)	Fault input 3 (minimum pressure sensor)

Outputs

MnPu_A	Main pump A
MnPu_B	Main pump B
MnVlvRtMx	Main MBRT 3-pos / main MBRT modulating





BSM	Boiler sequence manager
BSS	Boiler sequence selector
HD	Heat demand
Error	Fault supervision

6.2 Configuration

Basic configuration

By selecting a plant type in the basic configuration, function block “Boiler sequence manager“ will be activated. If several RMK770 are used, the function of boiler sequence manager is always assumed by the RMK770 that can acquire a measured value of 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	
MBRT return sensor	Sensor for maintained main boiler return temperature
Consumer return sensor	Return sensor on the consumer side
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
Fault input 1	Digital input for fault supervision of the boiler sequence
Fault input 2	Digital input for fault supervision
Fault input 3	Digital input for fault supervision
[Main pump] overload	Digital input for fault supervision of the main pump
[Main pump B] overload	Digital input for fault supervision of the main pump B (in case of a twin pump)
Flow signal	Digital input for flow supervision of the main pump
Heat requis modulating	
Heat requisition 2-position	
DHW requisition 2-pos	DHW requisition 2-position
Frost prot requisition 2-pos	

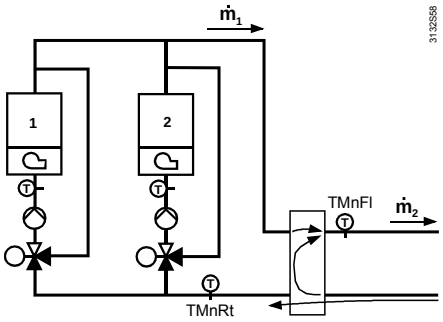
Outputs

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

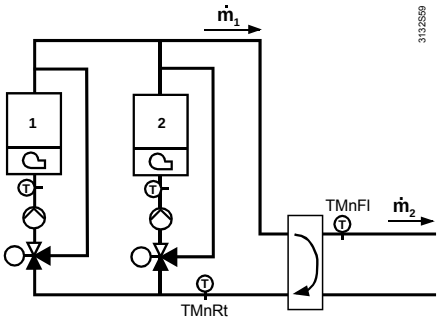
Operating line	*Adjustable values / remarks*
Main pump	
Main pump B	
Maint boiler return temp 3-pos	
Maint boiler return temp mod	

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

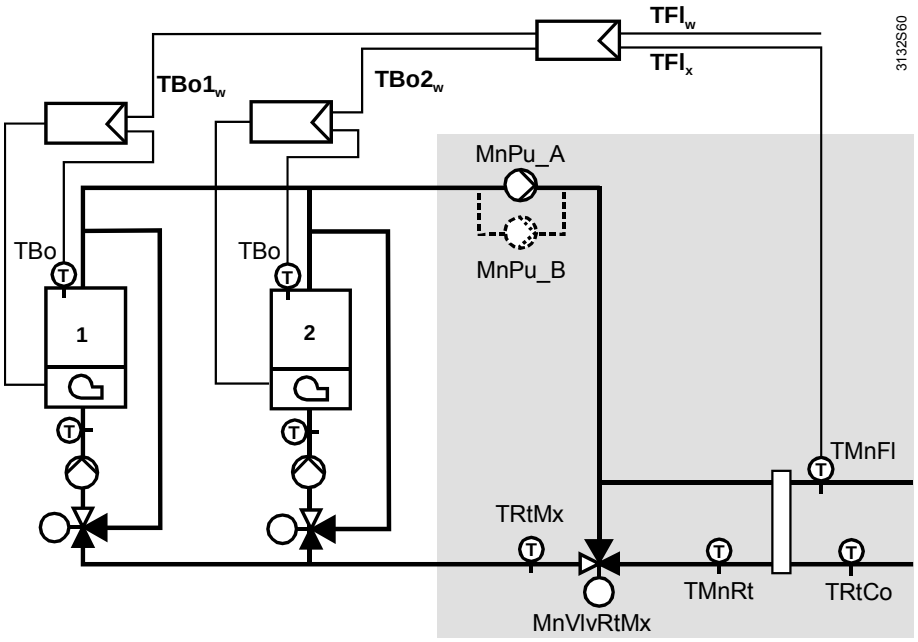
In addition to fault supervision of the main pump and supervision of the main flow temperature sensor, 3 binary fault inputs are provided for fault supervision of the boiler sequence. These are freely configurable.

Heat requisition

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

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 will also operate 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

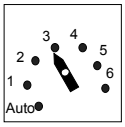
or Main menu > Boiler sequence manager > Boiler sequence optg mode

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

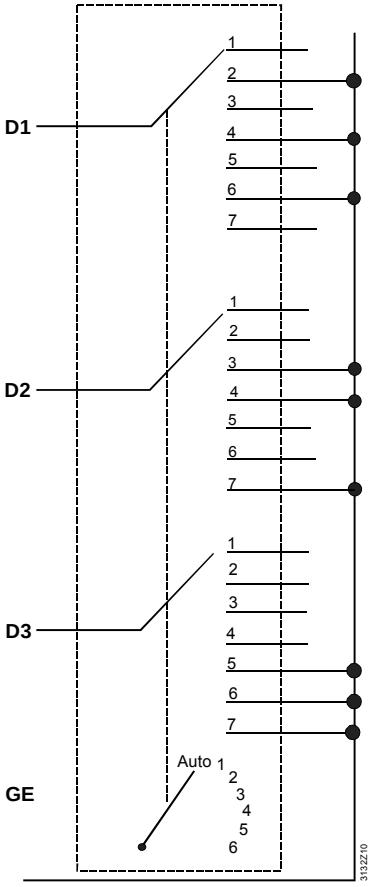
The input's operating mode can be parameterized for each terminal.

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 will be 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.

or 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, 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 the “Off" via digital input = Off, the boiler will **not** be 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*
Outside temp lock limit value	---- / 5…30 °C	---- °C

If the composite outside temperature (refer to subsection 10.6.1 “The composite and the attenuated outside temperature”) exceeds the limit value, the relevant boiler will be locked, or only released again with low priority (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 will be 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

or 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

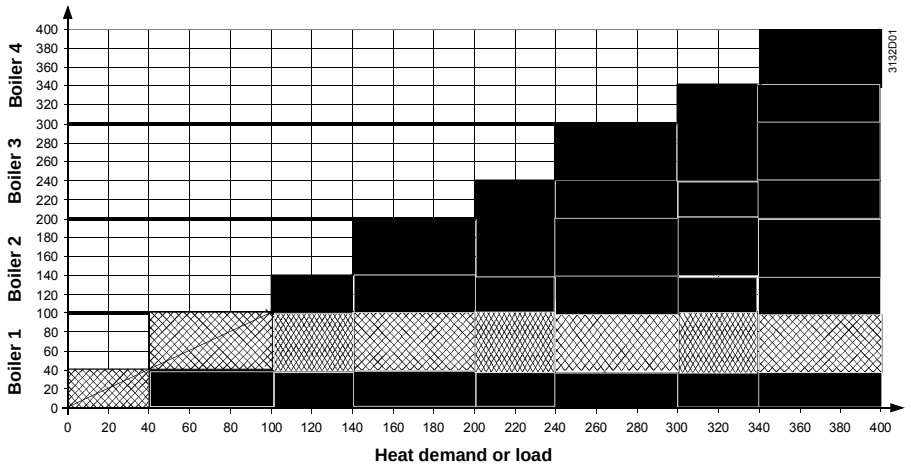
Standard

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

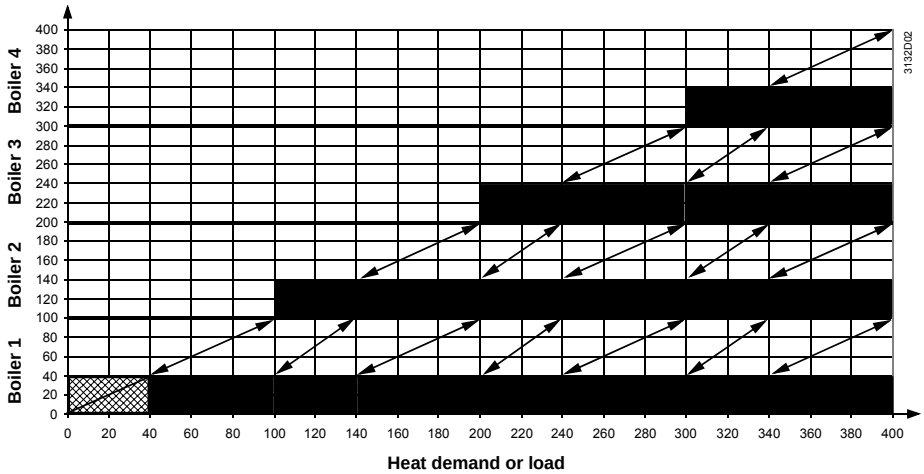
Operating line	*Range*	*Factory setting*
Setpoint increase lag boiler	0…50 K	10 K

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.

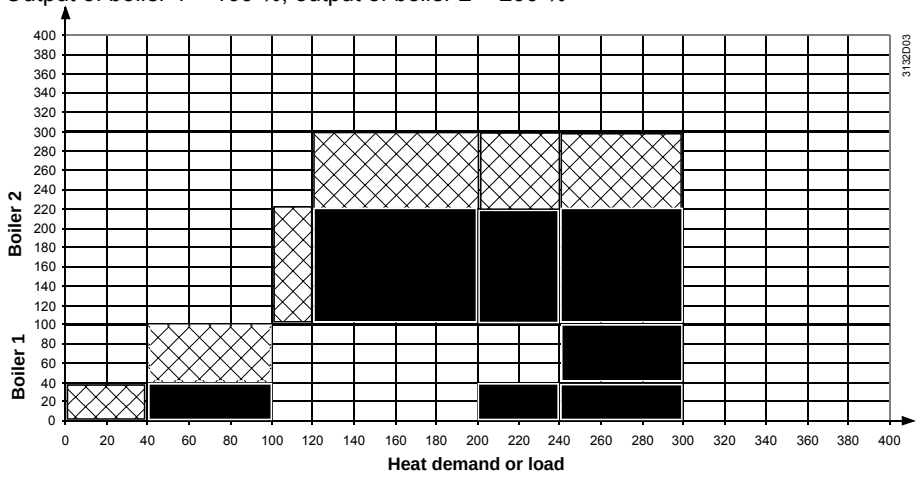
This approach can be chosen only if the output of the basic stage of boiler 2 exceeds the rated capacity of boiler 1. If this strategy is chosen, a fixed boiler sequence makes sense, thereby ensuring that the same boiler is always boiler no. 2.

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	Auto / Release DHW / Off	Auto
Setp preselection manual	---- / 8…140 °C	---- °C
Main flow temperature actual value		
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 requisition / Requisition	
Boil sequence selection manual	Auto / 1…6	Auto

Selection of the boiler sequence operating mode includes “Auto“, “Release DHW“ and “Off“.

In the “Release DHW“ mode, the only type of heat requisition considered is that of DHW heating (digital input or via Konnex bus).
Other types of heat requisition will be ignored. Requisitions of the emergency type are always considered.
In “Off mode, the only type of heat requisition taken into consideration is that of emergency (e.g. frost protection requisition 2-point at the heat requisition input).

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.

The operating action of the input 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.

6.3.5 Sustained mode

When there is no demand for heat, there is no need for the boiler sequence to deliver 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. In 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 requisition, 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 if a main pump – if installed – shall run in sustained mode or not. 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 one or several boilers.

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

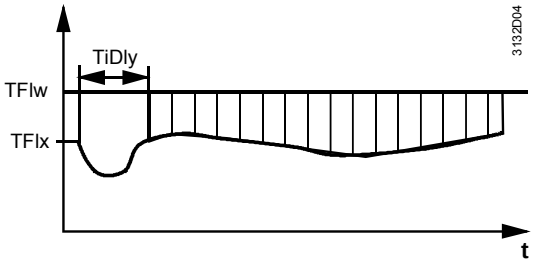
Operating line	*Range*	*Factory setting*
Upward sequence integral	0…500 K×min	200 K×min
Downward sequence integral	0…500 K×min	50 K×min

Operating line	*Range*	*Factory setting*
Upward sequence delay	0…255 min	5 min
Shortened upward seq DHW	0…100 %	0 %

Switching boilers on

Switching on via 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.

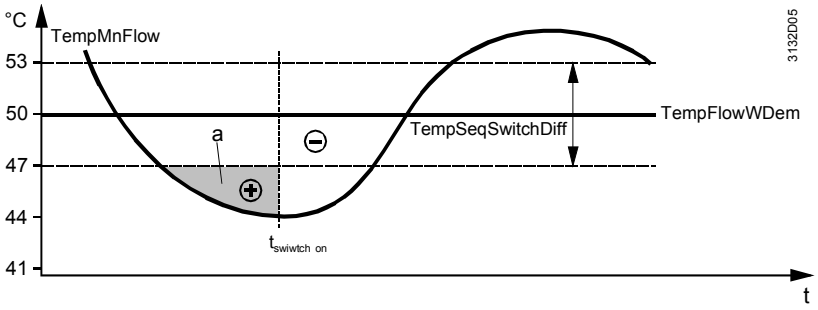


The moment an additional boiler is switched on, the flow temperature can drop for some time if the boiler was started up from “cold“. To prevent this undershoot from instantly switching on another boiler, a waiting time can be set before performance of the integral is started (TiDly, upward sequence 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 requisition, it is always the basic stage of at least one boiler that is released. If there is no temperature requisition, all boilers are immediately locked.
If heat consumption drops, the boilers are switched off based on the temperature criterion or output balance.

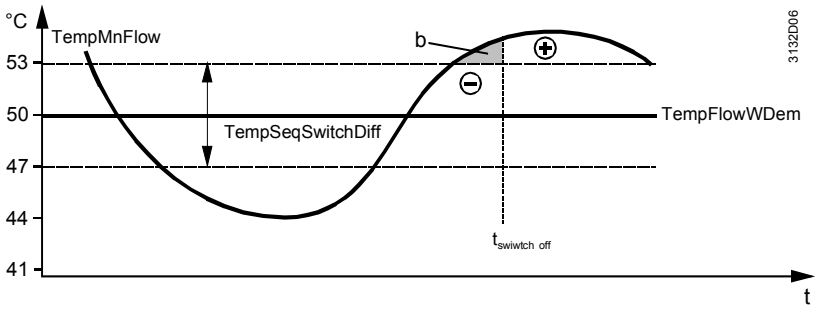
Switching off via the temperature-time integral

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

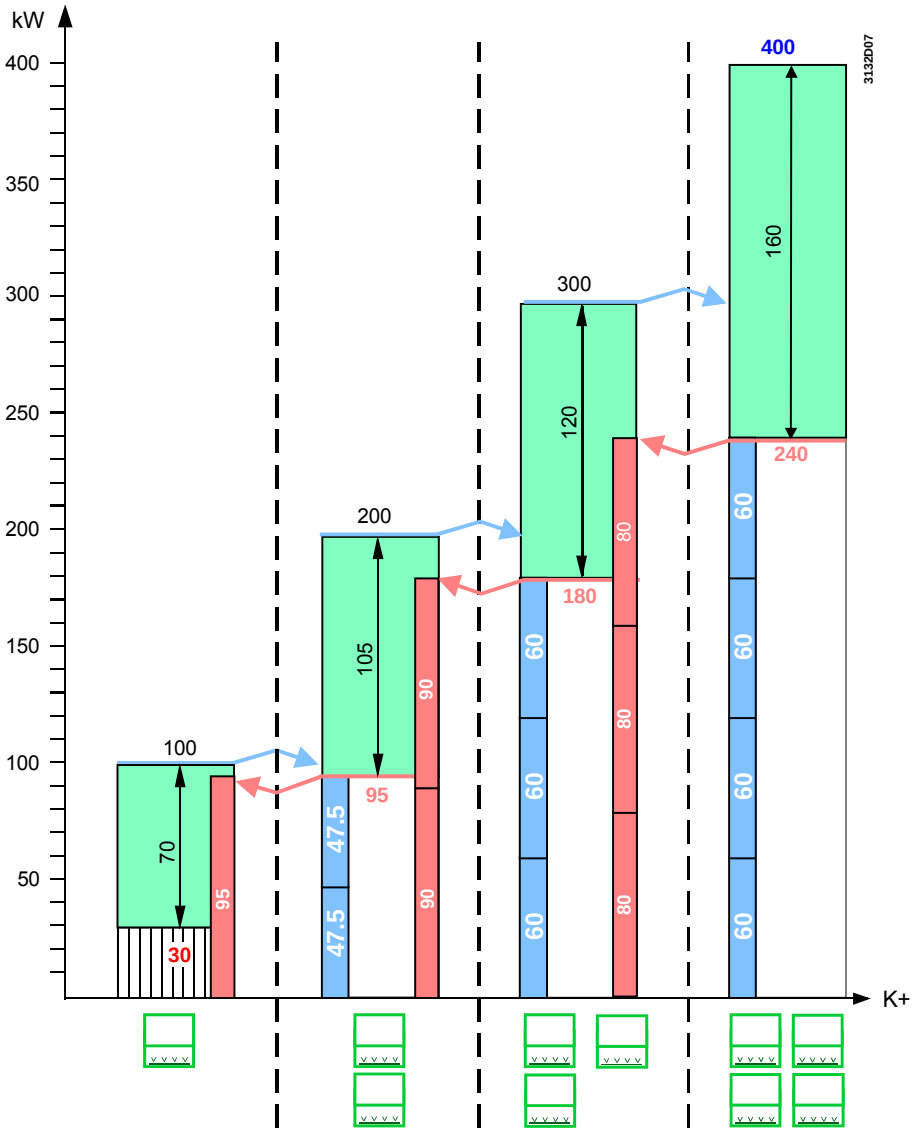
Switching off via the output balance prevents a large number of boilers from operating at low output although heat demand could be covered by a smaller number of boilers.

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 will be 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 will rise 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”.

Error messages

Number	*Text*	*Effect*
2491	[Main pump] overload	Nonurgent message; must be acknowledged and reset
2492	[Main pump B] overload	Nonurgent message; must be acknowledged and reset
2493	[Main pump] no flow	Nonurgent message; must be acknowledged and reset
2494	[Main pump B] no flow	Nonurgent message; must be acknowledged and reset
2495	[Main pump] fault	Urgent message; must be acknowledged and reset, 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 / Not urgent	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 / Not urgent	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 / Not urgent	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 will be shut down. Boilers and pumps will be 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

Error 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 12 “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, an error message will be delivered. It is only monitored whether the required temperature is reached. If the temperature is too high, no error message will be 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 will be no plant stop.

Error message

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

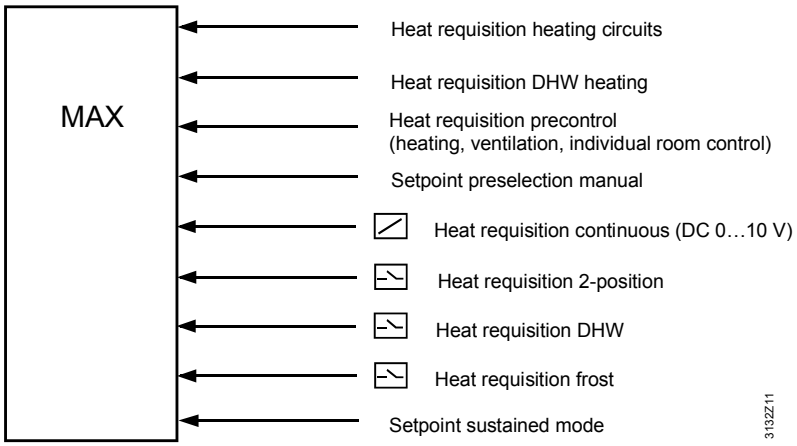
Sensor supervision in general

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.

Error 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

6.5 Heat demand and heat requisition



Function block “Boiler sequence manager“ collects the heat demand 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 requisition, 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 requis modulating	
Heat requisition 2-position	
DHW requisition 2-pos	
Frost prot requisition 2-pos	

The three 2-position heat requisitions differ in the type of heat requisition. 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.

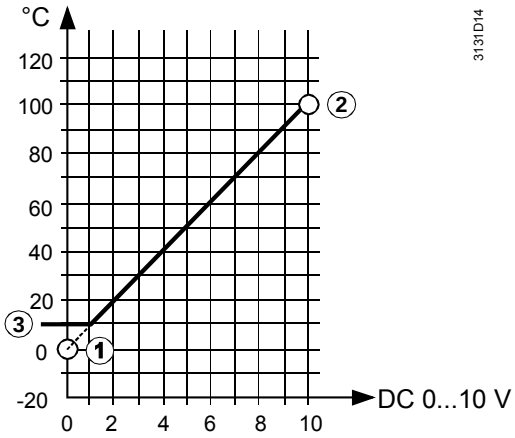
Boiler sequence optg mode	
Off	Only the frost input is considered
Release DHW	Generation of maximum value from the DHW and frost inputs
Auto	Generation of maximum value from all 3 inputs

Heat requisition 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 > Inputs > Heat requisition boiler sequence

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”)

Heat requisition 2-position

With the binary input, heat demand can be predefined in the form of a fixed value.
The “Inputs“ menu can be used to parameterize whether the input shall be activated with a closed or open contact.

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

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

Setting “Normal position = Open” means that a closed contact identifies a heat requisition.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Inputs > Heat requisition Heat requisition boiler sequence

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

Heat requisition 2-position [DHW or frost protection]

With the binary input, it is also possible to predefine a fixed value as a heat demand, which maximum value generation interprets like a heat requisition of the DHW or frost type.
Depending on the boiler sequence operating mode (see above), only 1 requisition of the DHW type and / or frost type is considered.

Main menu > Commissioning > Settings > ... or
Main menu > Main menu > Settings > Inputs > Heat requisition boiler sequence

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

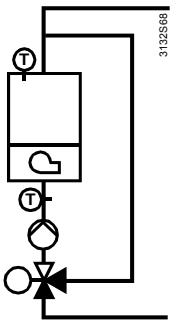
6.6 Other functions

6.6.1 Common maintained boiler return temperature

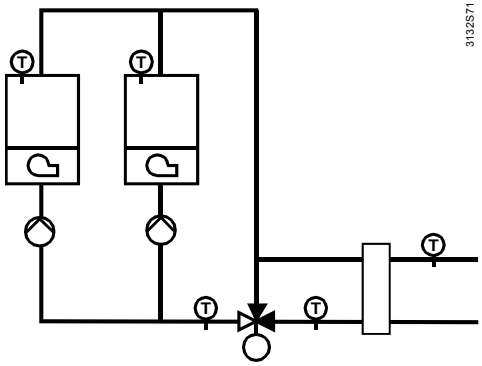
Minimum limitation of the return temperature shall ensure that, by the boiler inlet also, the temperature will not drop below the permissible value. In most cases, this is solved separately on each individual boiler. But it is also possible to perform this function for all boilers from a central location.

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	60 s
P-band Xp	1.0…100.0 K	20 K
Integral action time Tn	0.0…600.0 s	150 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

Frost protection for the boiler

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

Frost protection for the plant

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 requisition of 10 °C will be generated. If the temperature at the sensor returns to a level above 7 °C, the function will be deactivated. The function is active for a minimum of 5 minutes.

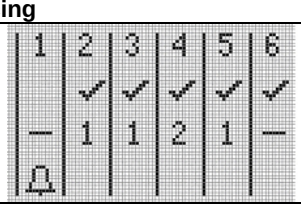
Frost protection for the consumer return temperature

If the temperature at the consumer return temperature sensor TRtCo falls below 5 °C, a heat requisition of 10 °C will be generated. If the temperature at the sensor returns to a level above 7 °C, the function will be 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. Release: Burner: Faults:	
Boiler sequence manager	
	State
	Cause
	Number of available boilers
Boiler sequence manager	
	Main flow temp actual value
	Main flow temp setpoint
	Main return temp actual value
	BRT 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:

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

Operating line	*Range*	*Factory setting*
Preselection	Auto / Release DHW / Off	Auto
Setp preselection manual	---- / 8…140 °C	---- °C
Actual value		
State		
Cause		
Boil sequence selection manual	Auto / 1…6	Auto

or Main menu > Boiler sequence manager > Boiler sequence selection

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

or Main menu > Boiler sequence manager > Boiler temperatures

Operating line	*Range*
[Boil address no 1] actual temp	
[Boil address no 2] actual temp	

Operating line	*Range*
[Boil address no 3] actual temp	
[Boil address no 4] actual temp	
[Boil address no 5] actual temp	
[Boil address no 6] actual temp	

or Main menu > Boiler sequence manager > Inputs / Setpoints

Operating line	*Range*
Main flow temp actual value	
Main flow temp setpoint	
Main return temp actual value	
MBRT. Return temp actual value	
MBRT. Return temp minimum	
Consumer return actual value	
Release input	
Heat requis modulating	
Heat requisition 2-position	
DHW requisition 2-pos	
Frost prot requisition 2-pos	

or Main menu > Boiler sequence manager > Fault inputs

Operating line	*Range*
Fault text	Fault text for fault input 1
Fault input 1	
Fault text	Fault text for fault input 1
Fault input 2	
Fault text	Fault text for fault input 1
Fault input 3	
[Main pump] overload	
[Main pump B] overload	
Flow signal pump	

or Main menu > Boiler sequence manager > Outputs

Operating line	*Range*
Main pump	
Main pump B	
Maint boiler return temp 3-pos	
Maint boiler return temp mod	

or Main menu > Boiler sequence manager > Limitations

Operating line	*Range*
MBRT. Return temp minimum	
Setpoint maximum limitation	

6.8 Error handling

Error main flow and main return temperature 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 acknowl-edged, no plant stop

Error main pump

Number	*Text*	*Effect*
2491	[Main pump] overload	Nonurgent message; must be acknowledged and reset
2492	[Main pump B] overload	Nonurgent message; must be acknowledged and reset
2493	[Main pump] no flow	Nonurgent message; must be acknowledged and reset
2494	[Main pump B] no flow	Nonurgent message; must be acknowledged and reset
2495	[Main pump] fault	Urgent message; must be acknowledged and reset, 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	Not urgent, must be acknowledged, no plant stop

Sensor supervision general

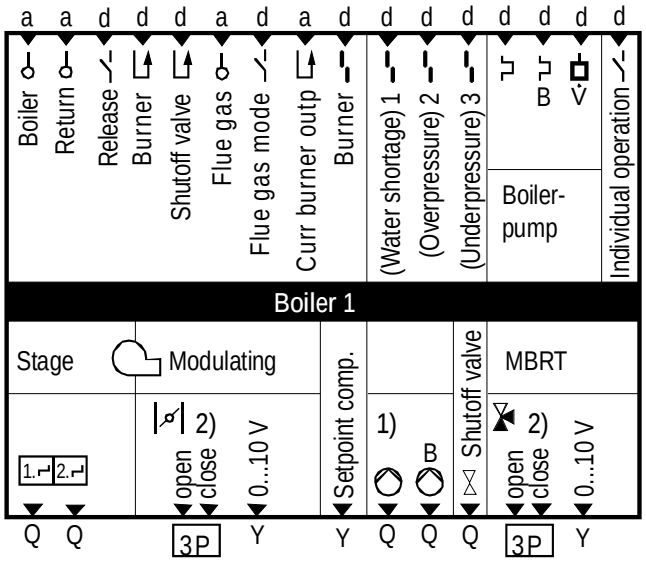
Number	*Text*	*Effect*
332	[Boiler seq] MBRT sensor error	Nonurgent message; must be acknowledged, no plant stop
333	Consumer return sensor error	Nonurgent message; must be acknowledged, no plant stop

Various errors

Number	*Text*	*Effect*
5593	Number of boilers wrong setting	Nonurgent message; must be acknowledged
5594	Invalid lead boiler	Nonurgent message; must not be acknowledged
2201	Heat requisition 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

7 Boiler temperature control

7.1 Function block overview

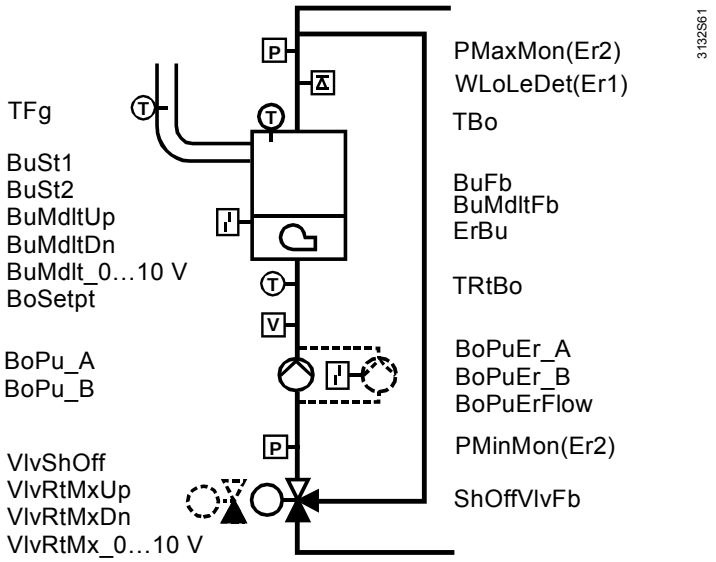


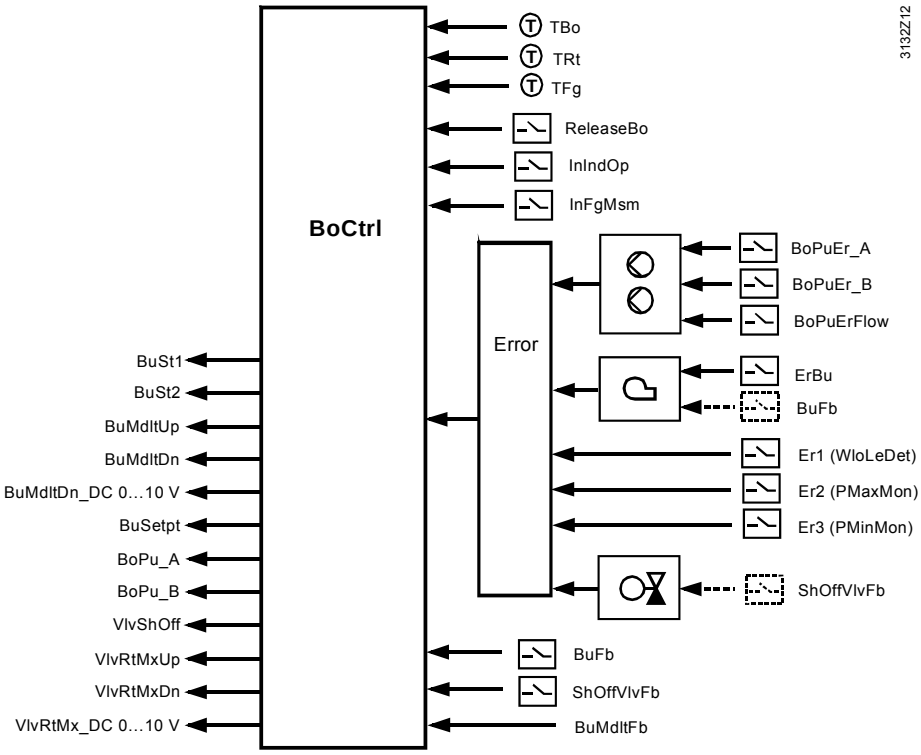
Inputs

TBo	Boiler temperature sensor
TRtBo	Return temperature sensor
Release Bo	Boiler release input
BuFb	Checkback signal burner stage 1
BuMdltFb	Checkback signal modulating burner, current burner output
ShOffVlvFb	Checkback signal shutoff valve
TFg	Flue gas temperature sensor
InFgMs	Control input flue gas measurement
ErBu	Fault input burner fault
Er1 (WLoLeDet)	Fault input 1 (water shortage)
Er2 (PMaxMon)	Fault input 2 (maximum pressure)
Er3 (PMinMon)	Fault input 3 (minimum pressure)
BoPuEr_A	Fault input boiler pump A
BoPuEr_B	Fault input boiler pump B
BoPuErFlow	Fault supervision boiler pump
InIndOp	Individual operation

Outputs

BuSt1	Burner stage 1
BuSt2	Burner stage 2
BuMdltUp	Burner modulating on
BuMdltDn	Burner modulating off
BuMdlt_ DC 0…10 V	Burner modulating DC 0…10 V
BoSetpt	Boiler temperature setpoint DC 0…10 V
BoPu_A	Boiler pump A
BoPu_B	Boiler pump B
VlvShOff	Shutoff valve
VlvRtMxUp	Maintained boiler return temperature on
VlvRtMxDn	Maintained boiler return temperature off
VlvRtMx_DC 0…10 V	Maintained boiler return temperature modulating DC 0…10 V





7.2 Configuration

Basic configuration

In the basic configuration, the function block is activated for the application. By selecting the plant type, the type of burner and boiler hydraulics will be preselected.
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	
Checkb sign shutoff valve	
Flue gas temperature sensor	
Flue gas meas mode contact	
Current burner output	
Fault burner	
Fault input 1	
Fault input 2	
Fault input 3	
[Boiler pump] overload	
[Boiler pump B] overload	
Flow signal pump	
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	
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 will automatically be preconfigured. In these cases, the sensor is a mandatory requirement. In all other cases, a return temperature sensor can be configured for display purposes.
Release input	Using the release input, a boiler can be locked from an external location. The operating action of the input can be parameterized at the respective terminal on Main menu > Settings > Inputs.
Checkback signal burner	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 will initiate 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 will initiate 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 set-point 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.

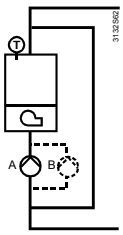
7.2.2 Boiler hydraulics

Definition of pumps

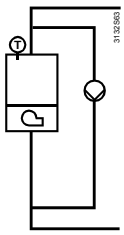
The following pumps are usually present:

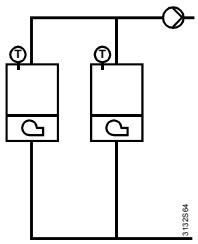
- One boiler pump per boiler
- The main pump for all boilers

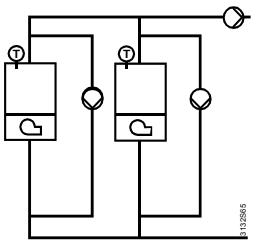
It is also possible to use a boiler pump as a mixing pump or a combination of mixing pump and main pump.



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. 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.

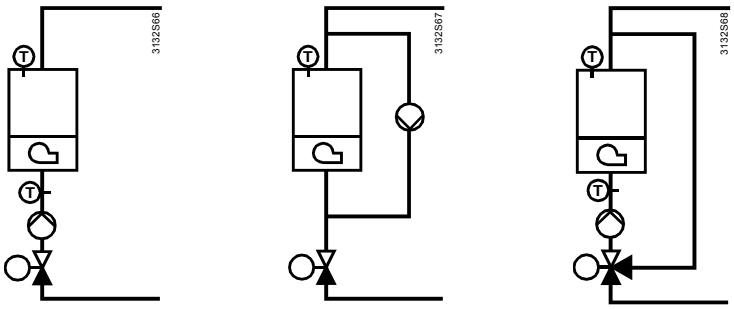
The single pump or twin pump can be monitored with a fault input and / or a flow switch. For more detailed information, refer to section 5.8 “Pump control and twin pumps”.

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

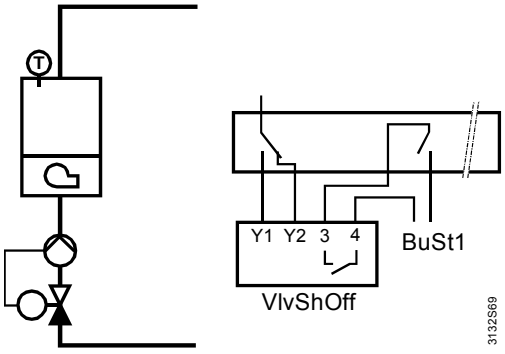


In most cases, every boiler can be hydraulically decoupled by using a shutoff valve. In the case of plant with a mixing valve for minimum limitation for the return temperature, this function is performed by the mixing valve. If the boiler is not released, the mixing valve is driven to the fully closed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

Shutoff valve

Shutoff valve for hydraulically decoupling the boiler from the system.
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 will be 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, an error message will be 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 will be activated on completion of the pump's switch-on delay; then, on completion of the burner's switch-on delay, the burner will be released.

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 requisition.
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 will be 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	On / Off	

Operating line	*Range*	*Factory setting*
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 / Requisition No requisition	

The user can switch off the boiler via operation.
If “Off” is preselected, the internal frost protection function remains active. Heat requisitions 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 > Commissioning > Settings > ... or
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 requisition 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 composite outside temperature exceeds the adjusted limit value, the boiler will be locked. If the composite outside temperature drops below the limit value by 1 K, the boiler will be released again.

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

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

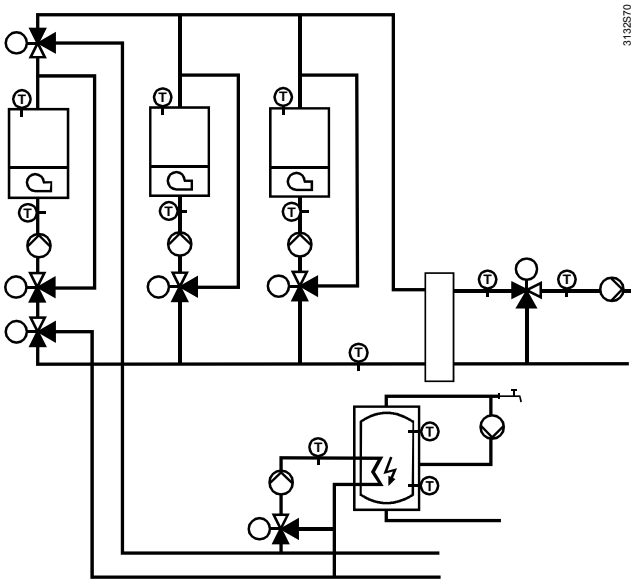
7.6 Individual operation

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

Main menu > Commissioning > Settings > ... or
Main menu > 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 plant commissioning and for test purposes, boiler and burner can be put into various operating states via the service level.

Main menu > Commissioning > Settings > ... or
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	

Auto

In “Auto“ 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 Burner control

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.

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:

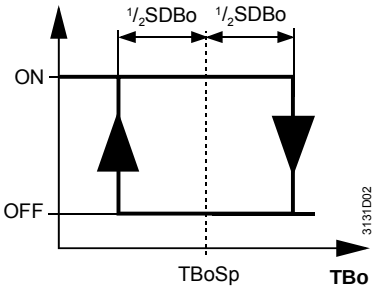
- Boiler switching differential
- Minimum burner running time

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

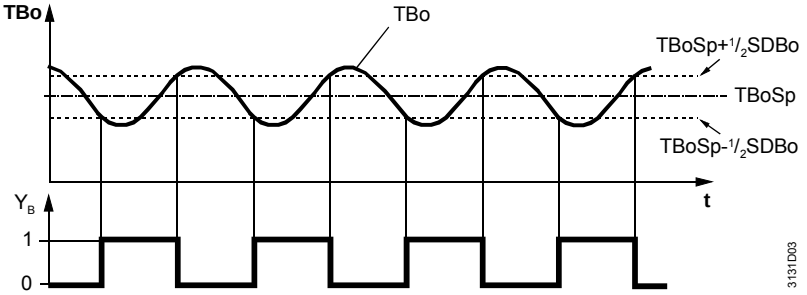
The controller compares the actual value of the boiler temperature with the setpoint. If the boiler temperature drops below the setpoint by half the switching differential, the burner will be started up. If the boiler temperature exceeds the setpoint by half the switching differential, the burner will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



SDBo Boiler switching differential
TBo Boiler temperature
TBoSp Boiler temperature setpoint

Minimum burner running time, burner cycling protection

If the switch-off point is reached before the minimum burner running time is completed, the burner will remain in operation until that time has elapsed (burner cycling protection). The minimum burner running time is given priority. When the maximum boiler temperature is reached, the burner will always shut down.



SDBo Boiler switching differential
t Time
TBo Boiler temperature
TBoSp Boiler temperature setpoint
Y_B Burner control signal

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 will also be switched off and stage 2 locked.

Burner stage 2

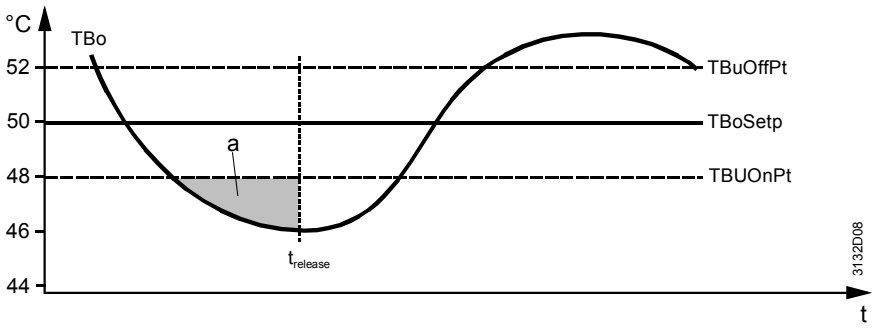
The release logic for 2-stage burner operation aims at ensuring an optimum switch-on time for stage 2 which, in addition to a time criterion, also considers the amount of the heat deficit, calculated with a temperature-time integral.

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.

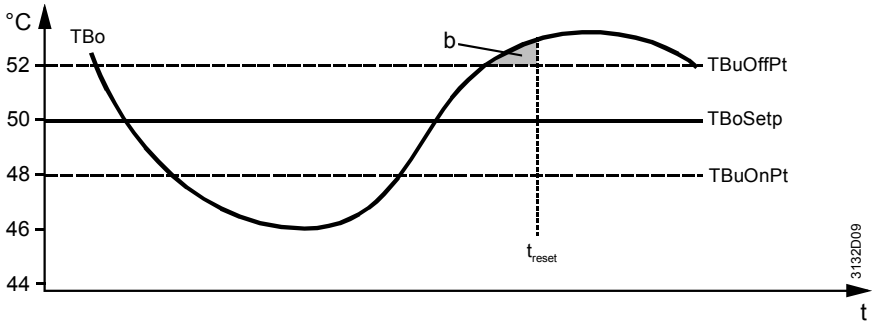


a	Release integral	TBo	Actual value boiler temperature
TBoSetp	Boiler temperature setpoint	t	Time
TBuOffPt	Burner's switch-off temperature	$t_{release}$	Time until release
TBuOnPt	Burner's switch-on temperature		

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 will be 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 will be released. During the time burner stage 2 is released, the controller switches burner stage 2 according to the switching differential.

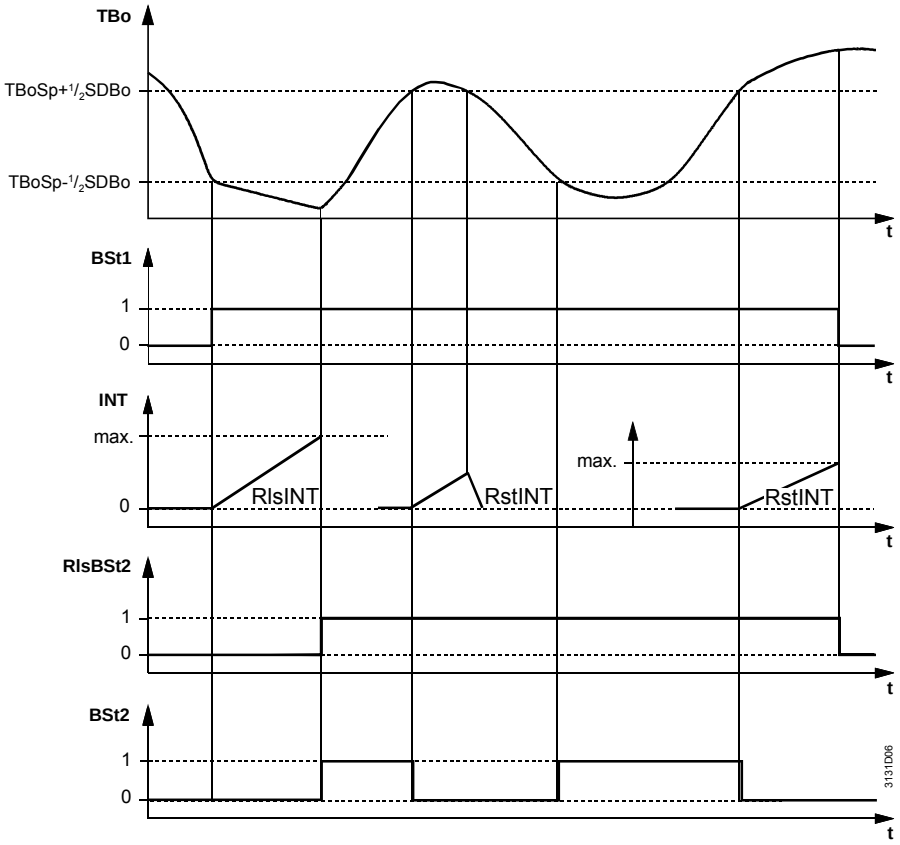
Logic for locking stage 2

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 will be 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 will be 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 will be 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.

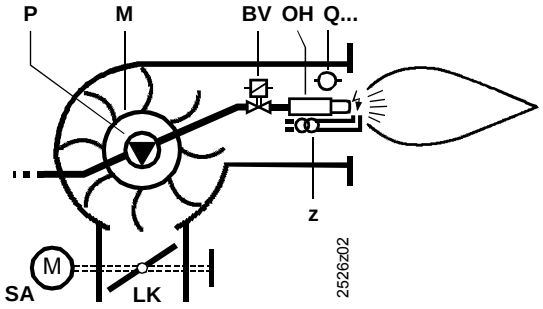
7.8.4 Control of modulating burners

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…200 K	20 K
Integral action time Tn	0…600 s	150 s
Derivative action time Tv	0…30 s	20 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 will also be 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

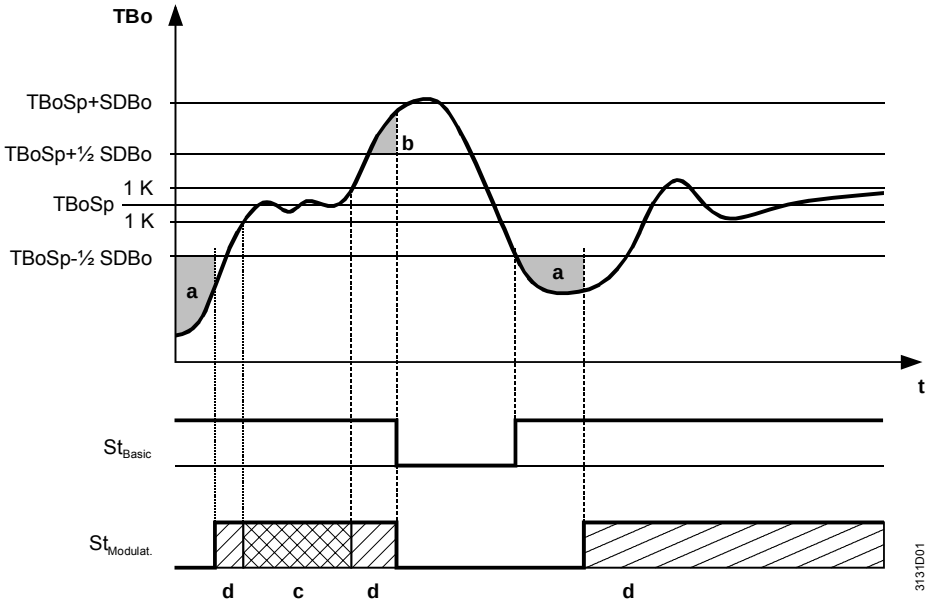
The functioning with regard to activation and deactivation of the basic stage corresponds to that of 2-stage burner operation. Release of modulation takes place analogously to the release of stage 2.
The parameters used for the release and reset integral are the same as those used for the 2-stage burner. 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 towards the fully closed position for a certain period of time. This ensures that, after the burner startup sequence (prepurging, ignition, stabilization of flame, etc.), the damper actuator will be driven to the start position so that only the basic stage will be used for heating.
Deactivation or locking of modulation occurs at the same moment in time as the change from the basic stage to cycling operation. If not yet done, the controller will again drive the damper actuator to the fully closed position.



Release integral 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 will be delivered.
If the boiler temperature does not stay long enough in the neutral zone or outside, positioning pulses will drive the actuator towards 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 will quickly increase heat production in a way that the boiler temperature will only slightly deviate from its setpoint, and for short periods of time only.
The 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 will be used. To optimize and check the control parameters, it is recommended to follow the procedure detailed below under "Checking the control function".

Checking the control function

To check the 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.

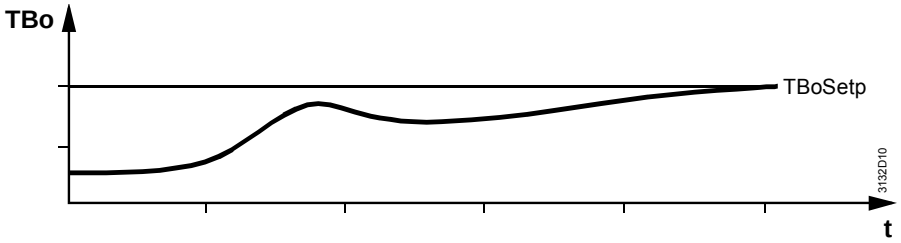
In principle, control must be stable, but it can be fast- or slow-acting.
If fast-acting control is required, the boiler temperature must reach the new setpoint fairly quickly.

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

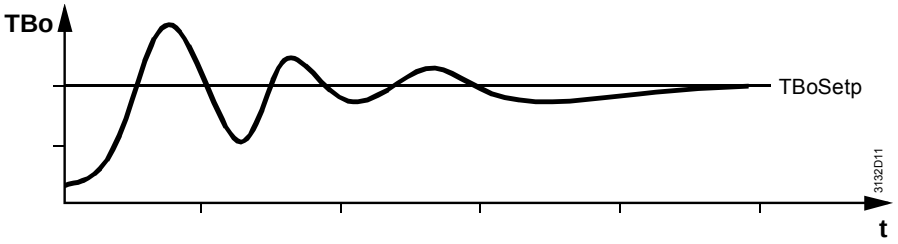
If the control system's response is too slow, setting parameters Xp, Tv and Tn must be decreased in a stepwise fashion. A new readjustment should be made only after the control action resulting from the previous readjustment is completed.



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 compensation > Boiler ...

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

Using setting parameters, the DC 0…10 V output can be matched to the recipient 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

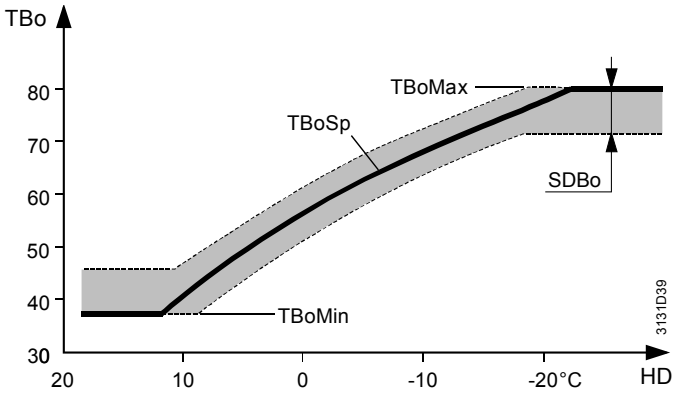
Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler > Limitations

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
Cons overrun time	0…60 min	6 min
Frost prot boiler pump	On / Off	On
Protective boiler startup	On / Off	On
Protective boiler startup	Pump on / Pump off	Pump on
Lock sig maintained boil ret temp	None / Uncritical / Critical	Critical
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's 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 requisition, the minimum boiler temperature is always active.

⚠ If a minimum return temperature is required, it must be ensured that the minimum boiler temperature will be set to a level which lies a few 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 will not fall below a minimum temperature.

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 detailes 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 will be 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

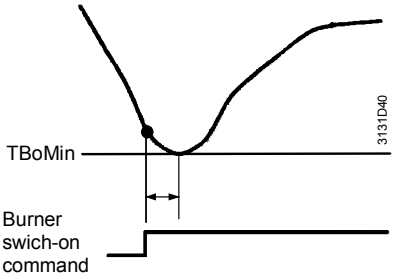
Protective boiler startup and frost protection for the plant

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.

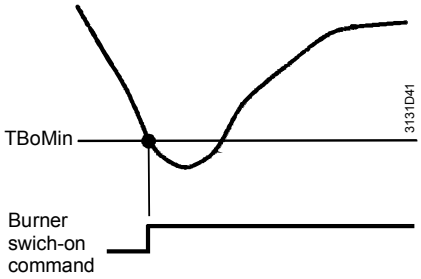
7.9.4 Optimization of the minimum boiler temperature

With setting “Optimization of the minimum boiler temperature“ = On”), the control selects the switch-on point such that, in normal situations, the boiler temperature will not drop below the minimum boiler temperature. 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 will not drop below the minimum limit. 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 requisition from one of the heat consumers. When there is no heat requisition, the boiler temperature can drop below the minimum boiler temperature.

Summer

In case of the “Summer setting, the boiler is maintained at the minimum boiler temperature only when the boiler has identified summer operation. The change to summer operation takes place at midnight if, previously, the boiler has received no heat requisition from the heating circuits for 48 hours. A heat requisition from DHW heating will be accepted, however.
The boiler also identifies summer operation if, for more than 48 hours, it has received no valid boiler temperature setpoint from the boiler sequence manager, or when the composite outside temperature has exceeded the outside temperature limit.

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 each 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 will be switched off again.

7.9.10 Protection against pressure shocks

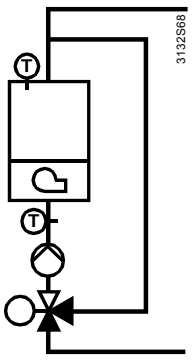
Main menu > Commissioning > Settings > ... or
Main menu > Settings > Boiler ... > Limitations

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

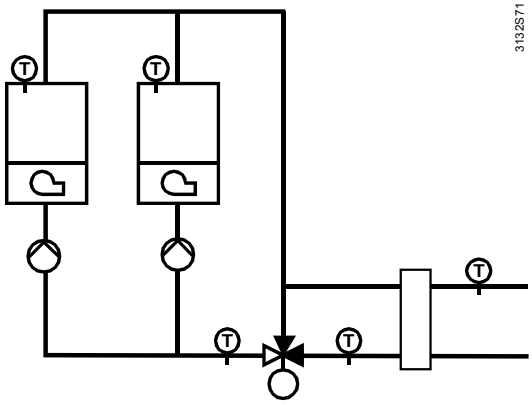
To prevent pressure shocks in the gas network if stages 1 and 2 switch off at the same time, stage 2 is already switched off before the maximum boiler temperature is reached the difference being the setting value “Boiler temp max” stage 2.
When the boiler sequence manager locks a boiler, stage 1 is switched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

7.10 Minimum limitation of the return temperature

Minimum limitation of the boiler return temperature is part of the boiler’s protective functions. Minimum limitation of the return temperature ensures that, by the boiler inlet also, the temperature will not drop below the permissible value.
If minimum limitation of the return temperature is required, it can be provided either by a separate mixing valve for the maintained boiler return temperature per boiler, a common mixing valve for the maintained boiler return temperature of all boilers, or by restricting the amount of heat drawn by the consumers.
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

If minimum limitation of the return temperature shall be provided with a mixing valve per boiler, that 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. Generally, 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

For adapting 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	120 s
P-band Xp	1…100 K	40 K
Integral action time Tn	0…600 s	40 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 will be driven to the fully closed position if the return temperature sensor is faulty and then deenergized to make possible manual adjustment.

If there is no return temperature sensor configured, a fault status message will appear. If only a return temperature sensor is configured with no mixing valve present, the sensor will be 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.
If a flue gas temperature sensor is configured, the following functions are available for selection:

Slave pointer function

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

Main menu > Boiler ... > Inputs/Setpoints

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

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 0 °C, thereby adopting the current value.
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 will be 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	---- / 0…400 °C	---- °C

When the flue gas temperature lies 5 K below that maximum flue gas temperature, the error message can be reset by acknowledging the error message. 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 / Not urgent	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	
Flue gas temperature maximum	

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.

and 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		

The function will be aborted after 30 minutes.
If the function is activated with one of the boilers, all boilers in the boiler sequence will be shut down. With the relevant boiler, the boiler pump and the peripheral devices will be put into operation. The boiler is assigned a boiler temperature setpoint of 90 °C. This value is limited by the maximum boiler temperature.
During the 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 will be delivered.

7.13 Boiler faults

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

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

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

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

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 will be signaled.

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 12 "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 / Not urgent	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 / Not urgent	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 / Not urgent	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 / Not urgent	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*

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 and twin pumps”.

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.

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
Burner start counter	0…99999	0

7.15 Error messages

Error boiler temperature sensor

Number	*Text*	*Effect*
301	[Boiler 1] boiler sensor error	Urgent message; must be acknowledged. Aggregate stop boiler 1
302	[Boiler 2] boiler sensor error	Urgent message; must be acknowledged. Aggregate stop boiler 2
303	[Boiler 3] boiler sensor error	Urgent message; must be acknowledged. Aggregate stop boiler 3
304	[Boiler 4] boiler sensor error	Urgent message; must be acknowledged. Aggregate stop boiler 4
305	[Boiler 5] boiler sensor error	Urgent message; must be acknowledged. Aggregate stop boiler 5
306	[Boiler 6] boiler sensor error	Urgent message; must be acknowledged. Aggregate stop boiler 6

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

Error return temperature sensor

Number	*Text*	*Effect*
311	[Boiler 1] return sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 1
312	[Boiler 2] return sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 2
313	[Boiler 3] return sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 3
314	[Boiler 4] return sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 4
315	[Boiler 5] return sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 5
316	[Boiler 6] return sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 6

In the case of plant with mixing valve for the maintained boiler return temperature, the mixing valve will be driven to the fully closed position when 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.

Error flue gas temperature sensor

Number	*Text*	*Effect*
321	[K1] flue gas temp sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 1
322	[K2] flue gas temp sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 2
323	[K3] Flue gas temp sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 3
324	[K4] flue gas temp sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 4
325	[K5] flue gas temp sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 5
326	[K6] flue gas temp sensor error	Nonurgent message; must be acknowledged. No aggregate stop boiler 6

Fault burner

Number	*Text*	*Effect*
2301	[K1 burner] fault	Urgent message; must be acknowledged. Aggregate stop boiler 1
2302	[K2 burner] fault	Urgent message; must be acknowledged. Aggregate stop boiler 2

Number	*Text*	*Effect*
2303	[K3 burner] fault	Urgent message; must be acknowledged. Aggregate stop boiler 3
2304	[K4 burner] fault	Urgent message; must be acknowledged. Aggregate stop boiler 4
2305	[K5 burner] fault	Urgent message; must be acknowledged. Aggregate stop boiler 5
2306	[K6 burner] fault	Urgent message; must be acknowledged. Aggregate stop boiler 6

Error burner operation supervision

Number	*Text*	*Effect*
2311	[K1 burner] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 1
2312	[K2 burner] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 2
2313	[K3 burner] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 3
2314	[K4 burner] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 4
2315	[K5 burner] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 5
2316	[K6 burner] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 6

Fault 1 (water shortage)

Number	*Text*	*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
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

Fault 2 (overpressure)

Number	*Text*	*Effect*
2331	[Boiler 1] overpressure	Priority, effect and acknowledgement can be parameterized.

Number	*Text*	*Effect*
		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

Fault 3 (underpressure)

Number	*Text*	*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
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

Error checkback signal shutoff valve

Number	*Text*	*Effect*
2351	[K1 valve] no checkback signal	Urgent message; must be acknowledged and reset. Aggregate stop boiler 1

Number	Text	Effect
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	Effect
2361	[K1] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Not urgent, no boiler stop, must be acknowledged and reset
2362	[K2] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Not urgent, no boiler stop, must be acknowledged and reset
2363	[K3] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Not urgent, no boiler stop, must be acknowledged and reset
2364	[K4] flue gas overtemperature	Priority and effect can be parameterized. Supply state Not urgent, no boiler stop, must be acknowledged and reset
2365	[K5] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Not urgent, no boiler stop, must be acknowledged and reset
2366	[K6] flue gas overtemperature	Priority and effect can be parameterized. Supply state: Not urgent, no boiler stop, must be acknowledged and reset

Overload boiler pump

Number	Text	Effect
2401	[K1 pump] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 1
2402	[K2 pump] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 2
2403	[K3 pump] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 3
2404	[K4 pump] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 4
2405	[K5 pump] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 5
2406	[K6 pump] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 6

Flow fault boiler pump

Number	Text	Effect
2411	[K1 pump] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 1
2412	[K2 pump] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 2
2413	[K3 pump] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 3
2414	[K4 pump] no flow	Nonurgent message; must be acknowl-

Number	Text	Effect
		edged and reset. No aggregate stop boiler 4
2415	[K5 pump] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 5
2416	[K6 pump] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 6

Overload boiler pump B

Number	Text	Effect
2421	[K1 pump B] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 1
2422	[K2 pump B] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 2
2423	[K3 pump B] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 3
2424	[K4 pump B] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 4
2425	[K5 pump B] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 5
2426	[K6 pump B] overload	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 6

Flow fault boiler pump B

Number	Text	Effect
2431	[K1 pump B] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 1
2432	[K2 pump B] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 2
2433	[K3 pump B] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 3
2434	[K4 pump B] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 4
2435	[K5 pump B] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 5
2436	[K6 pump B] no flow	Nonurgent message; must be acknowledged and reset. No aggregate stop boiler 6

Failure boiler pump

Number	Text	Effect
2441	[Boiler 1 pump] fault	Urgent message; must be acknowledged and reset. Aggregate stop boiler 1
2442	[Boiler 2 pump] fault	Urgent message; must be acknowledged and reset. Aggregate stop boiler 2
2443	[Boiler 3 pump] fault	Urgent message; must be acknowledged and reset. Aggregate stop boiler 3
2444	[Boiler 4 pump] fault	Urgent message; must be acknowledged and reset. Aggregate stop boiler 4
2445	[Boiler 5 pump] fault	Urgent message; must be acknowledged and reset. Aggregate stop boiler 5
2446	[Boiler 6 pump] fault	Urgent message; must be acknowledged and reset. Aggregate stop boiler 6

7.16 Boiler designations

Each boiler can be assigned a specific boiler designation.

The overview on the info page continues to show the boiler numbers, but the boiler-specific info page uses the boiler designations.
The menu also uses the boiler designations entered here.

Example of a boiler

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

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

A maximum of 20 characters can be entered.

7.17 Diagnostic choices

or Main menu > Boiler ... > Inputs / Setpoints

Operating line	*Adjustable values / remarks*
Actual value boiler temperature	
Boiler temperature setpoint	
Boiler switch-on temperature	
Boiler switch-off temperature	
Actual value return temp	
Return temperature min	
Burner hours run	
Burner start counter	
Release input	
Flue gas temperature	
Flue gas temperature maximum	
Flue gas temperature limit value	
Flue gas measuring mode	
Checkb signal burner	
Checkb sign shutoff valve	
Current burner output	
Individual operation	

or Main menu > Boiler ... > Inputs / Setpoints

Operating line	*Adjustable values / remarks*
Fault burner	
Fault text	Fault text for fault input 1
Fault input 1	
Fault text	Fault text for fault input 2
Fault input 2	
Fault text	Fault text for fault input 3
Fault input 3	
[Boiler pump] overload	
[Boiler pump B] overload	
Flow signal pump	

or Main menu > Boiler ... > Outputs

Operating line	*Adjustable values / remarks*
Burner stage 1	
Burner stage 2	
Modulating burner 3-pos	
Modulating burner mod	
Setpoint compensation	

Operating line	*Adjustable values / remarks*
Boiler pump	
Boiler pump B	
Shutoff valve	
Maint boiler return temp 3-pos	
Maint boiler return temp mod	

or Main menu > Boiler ... > Limitations

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

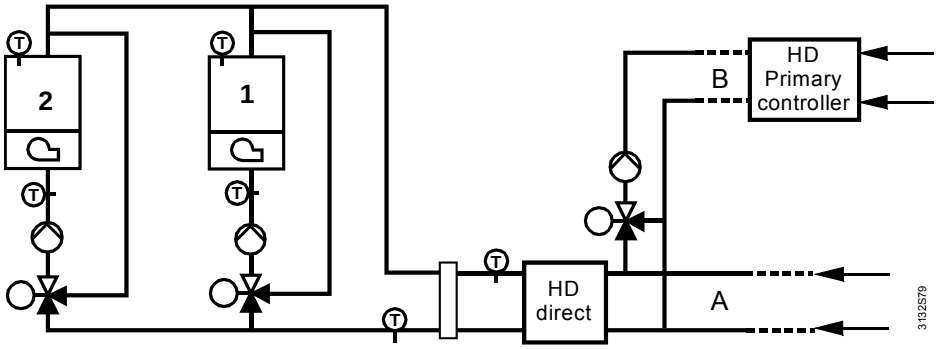
8 Heat demand and heat requisitions

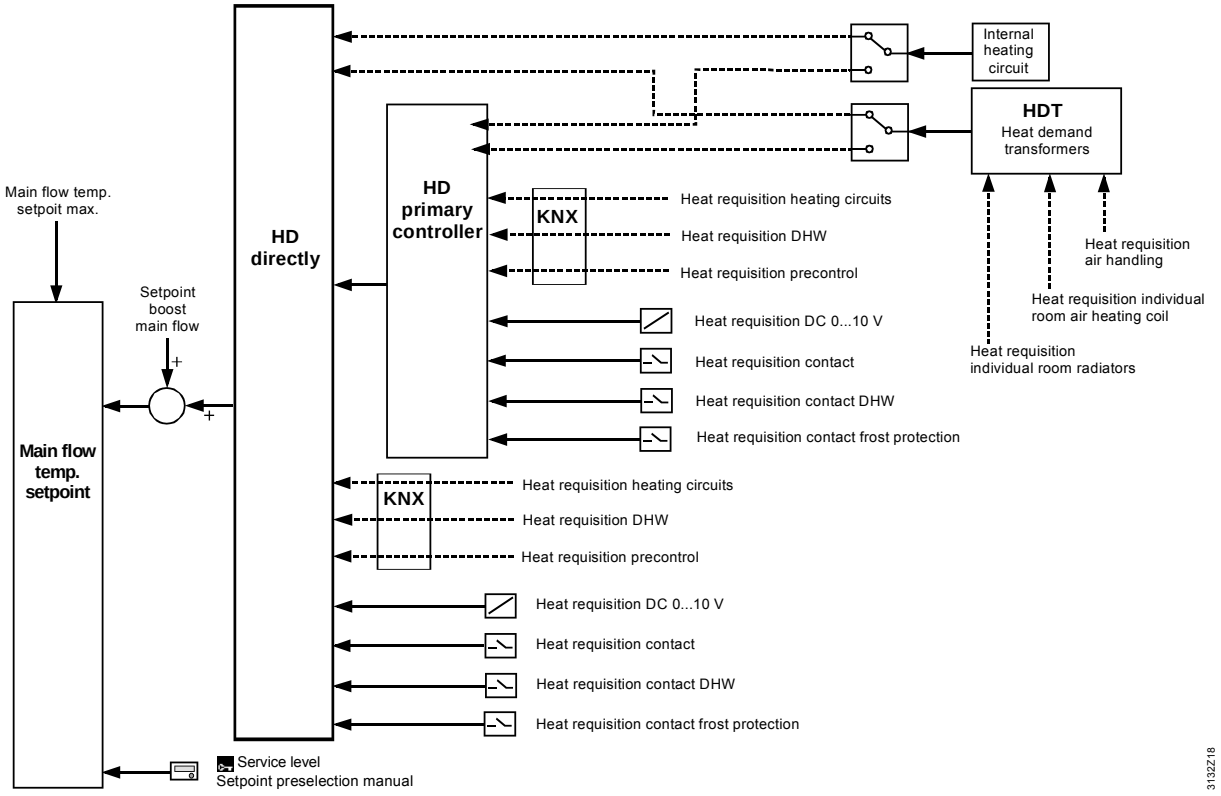
8.1 Heat requisitions

The following sources can deliver heat requisitions to the controller:

- The internal heating circuit
- External controls (KNX) via bus
- As continuous DC 0…10 V signals
- As 2-position signals

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





Notes

Direct delivery is described in chapter 6 “Boiler sequence management” and delivery via 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 requisition and weather-compensated heat requisition.

Example

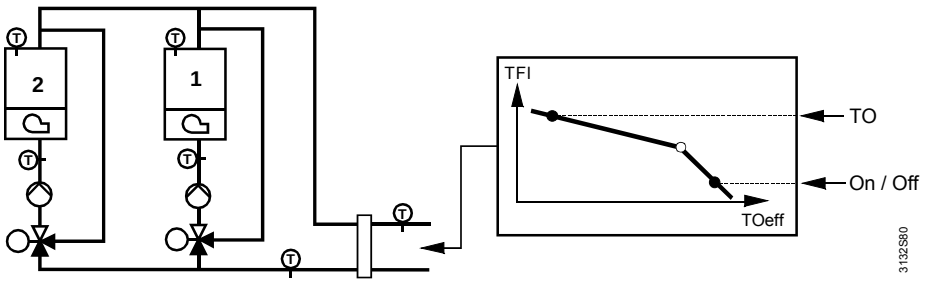
If the digital input for the room operating mode is used, it is possible to select the operating mode employed when the contact is active.

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 Konnex bus. For more detailed information, refer to subsection 13.3.2 “Outside temperature”.

Main menu > Commissioning > Extra configuration > Heating circuit

Operating line	*Range*	*Factory setting*
Heating circuit	Active / Inactive	Inactive



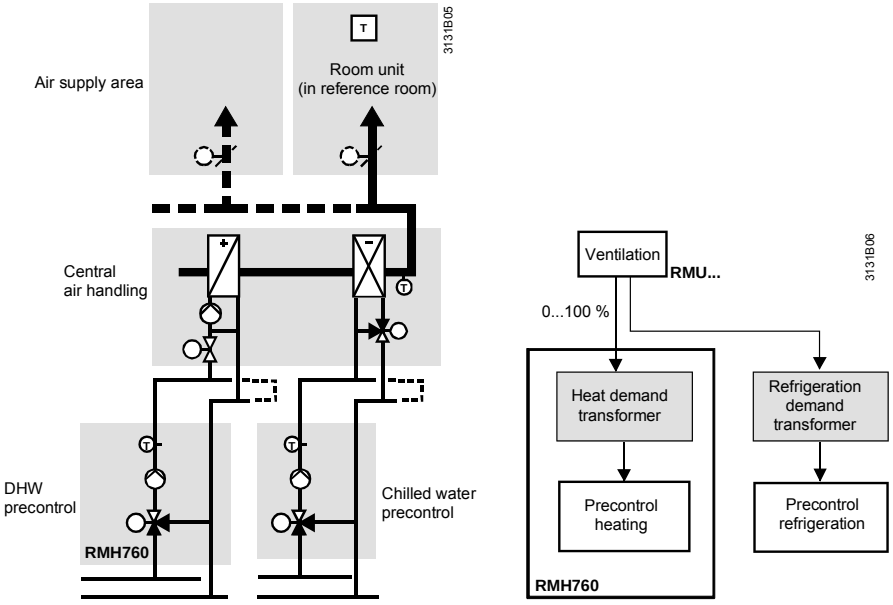
8.3 Heat demand transformer

The RMK770 has a heat demand transformer integrated. It receives and handles the heat requisition signals from:

- The individual room radiator (RXB…)
- The individual room air heating coil (RXB…)
- Air handling plant (RMU…)

The heat demand transformer converts the position heat requisition 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 will be 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 will be increased
- If the valve position is <90 %, the flow temperature will be decreased

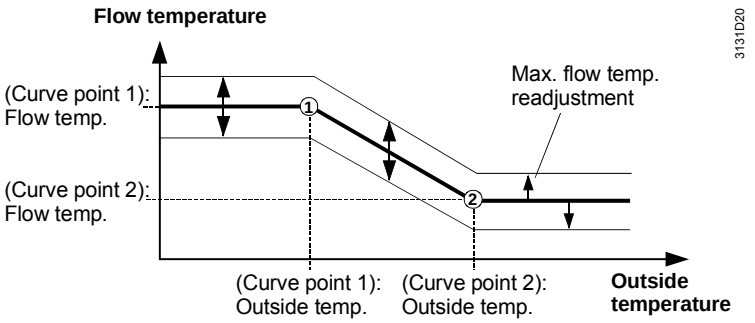
The maximum flow temperature readjustment can be parameterized.

To ensure that minimum opening travel of the valve will not 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 will be suppressed again

Main menu > Settings > Inputs > 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
Requisition evaluation	Maximum / Average	Maximum
Limit value requisition on	(Threshold off)…100 %	10 %
Limit value requisition off	0…(threshold on)	5 %

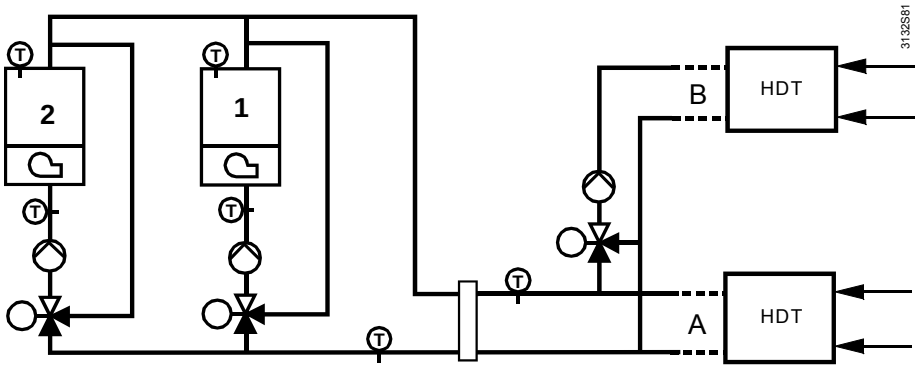


The adaptation of the flow temperature can be set as follows:

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

Main menu > Commissioning > Extra configuration > Heat requisition %

Operating line	*Range*	*Factory setting*
Heat requisition % on	Main distributor / Primary controller	Main distributor

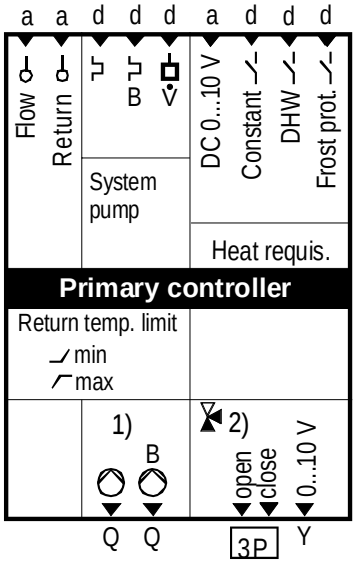


Using setting ... > Heat requisition % on: Main distributor (A) or primary controller (B), it can be defined where the heat requisition of the heat demand transformer shall be delivered.

This also means that there is only 1 heat demand transformer. Hence, only the main distributor or primary controller can receive the heat demand from an RMU7…, for example.

9 Precontrol

9.1 Function block overview



Inputs

Flow temperature sensor
Return temperature sensor

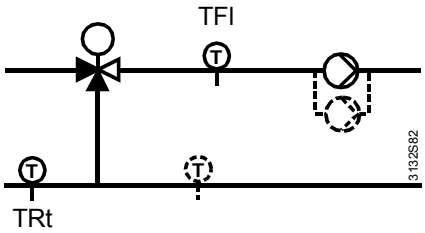
Fault input “System pump A“
Fault input “System pump B“
Flow supervision “System pump“

Heat requisition modulating (DC 0…10 V)
Heat requisition 2-position
DHW requisition 2-position
Frost protection requisition 2-position

Outputs

System pump A
System pump B

Primary controller mixing valve opening
Primary controller mixing valve closing
Mixing valve modulating DC 0…10 V



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*
System pump	
System pump B	
Mixing valve 3-pos	
Mixing valve modulating	

Inputs

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

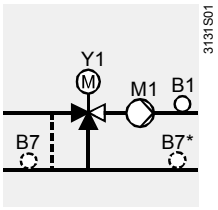
Operating line	*Adjustable values / remarks*
Flow sensor	
Return sensor	
[System pump] overload	
[System pump B] overload	
Flow signal pump	
Heat requis modulating	
Heat requisition 2-position	
DHW requisition 2-pos	
Frost prot requisition 2-pos	

Heat requisition

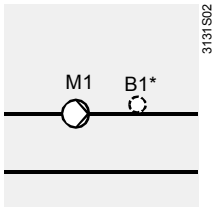
The heat requisitions can be sent to other devices via bus. In addition, there are 3 binary inputs and 1 analog input for transmitting heat requisitions.

9.2.1 Types of primary controllers

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
B1* Flow temperature sensor (optional, for display only)
B7 Return temperature sensor (optional, for minimum limitation)
B7* Return temperature sensor (optional, for maximum limitation)
M1 System pump (can be a twin pump)
Y1 Mixing valve

Primary controller type 1 with mixing circuit can provide optional minimum or 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.

9.2.2 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.

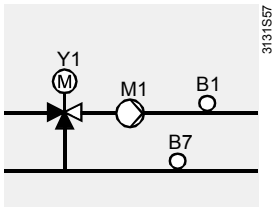
9.2.3 Pump control

The pump used with the primary controller offers the same choices as all the other pumps. The pump can be monitored as an individual pump or, optionally, a twin pump can be used as a pump of the primary controller. In that case, the relevant output must be configured.
For more detailed information about pump control and twin pumps, refer to section 5.8 “Pump control and twin pumps”.

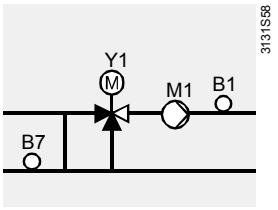
9.2.4 Return temperature limitation primary controller

Return sensor

If minimum or maximum limitation of the return temperature is required, a return temperature sensor must also be configured.
Limitation of the return temperature is only possible with primary controller type 1. The mixing valve of the primary controller can be used for maximum or minimum limitation of the return temperature, depending on the type of hydraulic system.



Maximum limitation



Minimal limitation

Functions

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

Operating line	*Range*	*Factory setting*
Type of return temp limitation	Minimum / Maximum	Minimum

Settings

Main menu > Settings > Primary controller > Limitations

Operating line	*Range*	*Factory setting*
Return temperature min*	--- (none) / 0…140 °C	--- °C
Return temperature max*	--- (none) / 0…140 °C	--- °C

* Displayed or hidden, depending on the type of limitation

The function becomes active only if a valid value is set here.

Maximum limitation of the return temperature

If the return temperature exceeds the limit value, the primary controller’s flow temperature setpoint will be lowered. When the return temperature returns to a level below the limit value, the lowering of the flow temperature setpoint will be gradually reduced. Limitation operates as an I-controller whose integral action time can be adjusted.

Main menu > Settings > Primary controller > Mixing circuit controller

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

Minimum limitation of the return temperature

If the return temperature falls below the limit value, the primary controller's flow temperature setpoint will be lowered. When the return temperature returns to a level above the limit value, the lowering of the flow temperature setpoint will be gradually reduced. Limitation operates as an I-controller. The integral action time is entered as a fixed value.

9.3 Text designation of the primary controller

Main menu > Settings > Primary controller

Operating line	*Range*	*Factory setting*
Primary controller	Text A…Z	Primary controller

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

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 / Requisition / Frost protection for consumer / Frost protection for the flow / Frost protection for the plant / Overtemp protection/overrun / Plant operation selector / No requisition	

* Frost protection functions are ensured

Preselection (plant operation selector)

For service purposes, the primary controller can be switched off. In that case, the valve will be 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 will remain active and frost protection-related heat requisitions (frost protection for the flow) from externally will be accepted and handled.

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

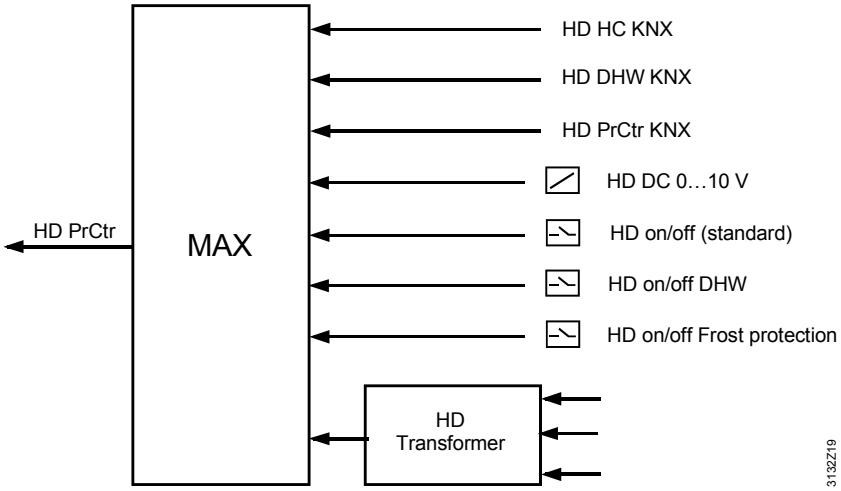
State

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 requisition



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 requisition inputs.

Extra configuration

Main menu > Commissioning > Extra configuration > Primary controller > Inputs > Heat requis modulating Assign terminal

Main menu > Commissioning > Extra configuration > Primary controller > Inputs > Heat requisition 2-position Assign terminal

Main menu > Commissioning > Extra configuration > Primary controller > Inputs > DHW requisition 2-pos Assign terminal

Main menu > Commissioning > Extra configuration > Primary controller > Inputs > Frost prot requisition 2-pos Assign input

From all requisition 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 primary controller’s setpoint boost and send to a heat source or another primary controller as “Heat demand of precontrol”.

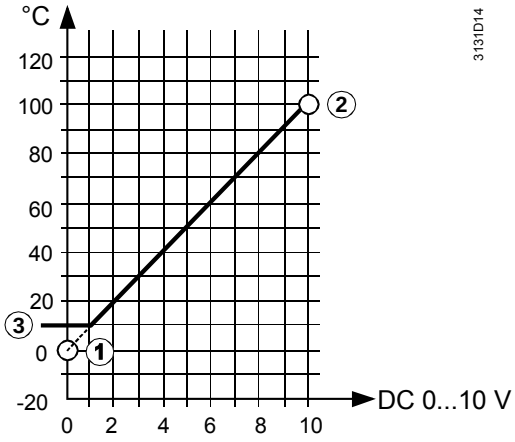
9.5.1 Heat requisition modulating

A heat requisition can be preselected with a DC 0…10 V signal.

Main menu > Settings > Inputs > Heat requisition Primary controller

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

Following diagram shows adaptation of the signal input to the signal source.



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”)

“Value low” is defined as the flow temperature setpoint at DC 0 V; “Value high” as the flow temperature setpoint at DC 10 V. Input voltages 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:
Value low: 20 °C
Value high: 120 °C

9.5.2 Heat requisition 2-position

Main menu > Settings > Inputs > Heat requisition Primary controller

Operating line	*Range*	*Factory setting*
[2-pos] setpoint normal	5…140 °C	70 °C
[2-pos] setpoint DHW	5…140 °C	70 °C
[2-pos] setpoint frost prot	5…140 °C	70 °C

3 types of digital inputs are available. Each of them can be used to preselect a fixed value for heat demand.
The 3 digital inputs are distinguished in the way they handle the demand for heat.

- A signal at input “[2-pos] setpoint normal“ is handled like heat demand from a heating circuit
- A signal at input “[2-pos] setpoint DHW“ is handled like that of DHW heating
- A signal at input “[2-pos] setpoint frost prot“ is handled like heat requisition resulting from risk of frost

Depending on the plant’s state, a normal requisition can be ignored in the summer, for example, while consideration is given to a requisition for frost protection.

Whether an input shall be active when the contact is open or closed, can be parameterized for each input individually.

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

The heat demand transformer described in chapter 8 “Heat demand and heat requisitions” can be linked either to the primary controller or directly to the boiler sequence manager (main distributor). The selection is made in Extra configuration > Heat requisition [%]
When using setting heat requisition [%] on the “Primary controller”, the transformer is linked to the primary controller. Per default, the transformer is linked to the main distributor.

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 > Settings > Primary controller > Mixing circuit controller

Operating line	*Range*	*Factory setting*
Actuator run time	1…600 s	120 s
P-band Xp	1…100 K	40 K
Integral action time Tn	0…600 s	20 s
Locking signal gain	0…200 %	100%

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 necessitates 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 pipes between boilers and consumers, heat losses on the way to the consumers can occur, depending on the quality of pipe lagging, so that setpoint boost can be desirable in those situations also.

Operating line	*Range*	*Factory setting*
Setp boost primary controller	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 Konnex 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 terminated as soon as the flow temperature has risen to 7 °C. The function is 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

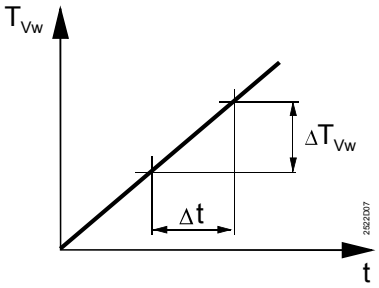
This setting provides minimum limitation of the flow temperature setpoint. Minimum limitation is only active when there is demand for heat.
Using setting --- (none), the function can be deactivated.

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: = $\Delta T_{Vw} / \Delta t$

t Time
Δt Unit of time
TVw Flow temperature setpoint
ΔTVw Rate of setpoint increase per unit of time

Return temperature limitations

Refer to subsection 10.4.2 “Limitation of the return temperature”.

System pump and locking signals

Setting “System pump locking signal = Off“ means that the system pump shall also respond to locking signals.

Settings

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
Return temp min*	---- / 0…140 °C	---- °C
Return temp max*	---- / 0…140 °C	---- °C
Frost protection for the plant	Off / On	On

* Displayed or hidden, depending on the type of limitation

9.8.3 Pump overrun and mixing valve overrun

To protect the boiler against overtemperatures after the burner has shut down (when there are no more active heat consumers), an overrun time for the consumers can be set on the boiler controller.
After the burner has shut down, the overrun time ensures that the heating circuits and DHW heating will 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 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.

9.8.4 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 Error handling

Error 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, an error message will be delivered.

Errors of sensors

Number	*Text*	*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 will be driven to the fully closed position to become inactive (3-position actuator), so that it can be manually operated.

Sensor error return temperature

Number	*Text*	*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.

Error heat requisition modulating

Number	*Text*	*Effect*
2201	Heat requisition mod error	Nonurgent message; must not be acknowledged

An error at the input will be interpreted as “No heat demand”.

Fault primary controller or system pump

No.	*Text*	*Effect*
2501	[System pump] overload	
2502	[System pump B] overload	
2503	[System pump] no flow	
2504	[System pump B] no flow	
2505	[System pump B] fault	Urgent, must be acknowledged and reset

9.10 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
Return temperature min	…°C
Heat requisition modulating	---- (= not connected) / …°C
Heat requisition 2-position	0 / 1 (1 = closed)
DHW requisition 2-pos	0 / 1 (1 = closed)
Frost prot requisition 2-pos	0 / 1 (1 = closed)
[System pump] overload	0 / 1 (1 = overload)
[System pump B] overload	0 / 1 (1 = overload)
Flow signal pump	

Main menu > Primary controller > Outputs

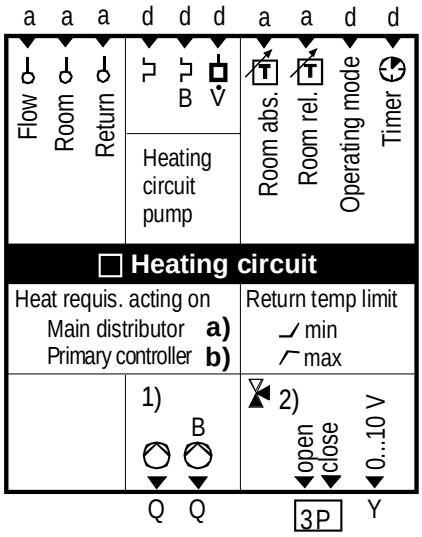
Operating line	*Range*
System pump	Off / On
System pump B	Off / On
Mixing valve 3-pos	Closing / ---- / Opening
Mixing valve modulating	0…100 %

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
Return temperature min	Inactive/ Active

10 Heating circuit control

10.1 Function block overview



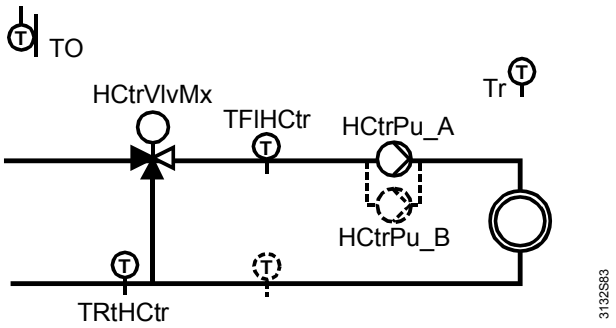
Inputs

Flow temperature sensor
Return temperature sensor
Room temperature sensor
Room setpoint abs.
Room setpoint rel.
Room operating mode
Timer function

Fault input heating circuit pump A
Fault input heating circuit pump B
Flow supervision heating circuit pump

Outputs

Heating circuit pump A
Heating circuit pump B
Heating circuit mixing valve opening
Heating circuit mixing valve closing
Heating circuit mixing valve modulating DC 0…10 V



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*
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 with the flow sensor and the actuating devices.
By assigning the relevant inputs (flow temperature sensor) and outputs (heating circuit pump, mixing valve) to terminals, a “real heating circuit” will be activated.
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 Konnex bus. For more detailed information, refer to subsection 13.3.2 “Outside temperature”.

Outputs

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

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

Inputs

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

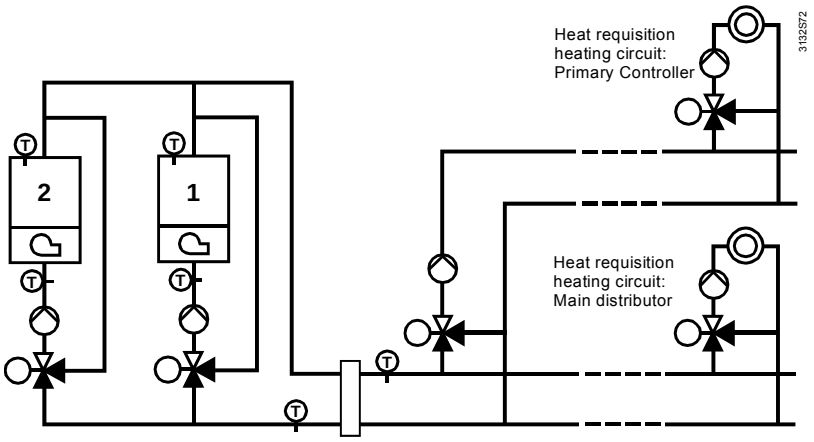
Operating line	*Adjustable values / remarks*
Flow sensor	
Room sensor	
Return sensor	Return temperature limitation
[Heating circuit pump] overload	Fault input heating circuit pump
[Heat circuit pump B] overload	
Flow signal pump	Flow supervision heating circuit pump
Room setpoint adjuster abs	External room temperature setpoint adjuster with absolute room temperature setpoints
Room setpoint adjuster rel	External room temperature setpoint adjuster with room temperature setpoint readjustment of ±3 K
Room operating mode	
Timer function	Comfort extension

Heat requisition heating circuit

The internal heating circuit can be connected directly to the main distributor or after the primary controller (if 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 and twin pumps”.

10.3 Text designations for the heating circuit

Main menu > Settings > Heating circuit

Operating line	*Range*	*Factory setting*
Heating circuit	Text A…Z	Heating circuit

The heating circuit can be assigned its specific text. This text will appear on the menu and on the info display.

10.4 Auxiliary functions

10.4.1 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 Konnex bus.
The average will be generated from the 2 actual values.

Types of sensors

The type of room temperature sensor can be selected (example with input terminal RMK770.X4):

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-Ni 1000 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

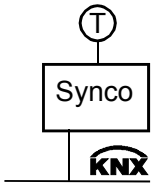
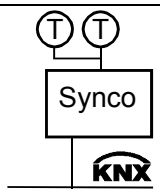
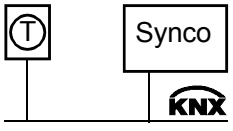
If the controller is activated on the bus with an appropriate device address, the room temperature can be delivered and received via bus.

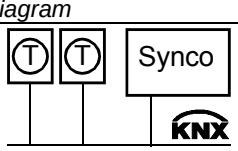
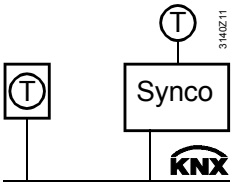
Sending

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.

Receiving

The room temperature signal sent via bus is received by the heating circuit, provided the room zone (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. If the RMK770 on the bus 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. If the RMK770 on the bus 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)	If the RMK770 on the bus is activated, the heating circuit receives the room temperature of the same geographical zone. The heating circuit operates with the room temperature it has received.	

Variant	*Effect*	*Diagram*
2 room sensors or 1 Konnex room sensor and 1 room unit QAW740*	If the RMK770 on the bus 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 Konnex room sensor (or 1 room unit QAW740)	If the RMK770 on the bus is activated, the heating circuit receives the room temperature of the same geographical zone. The heating circuit operates with the average of the 2 temperatures.	

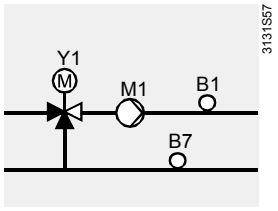
* 2 QAW740 room units are not permitted! Operation in the room is only possible on one unit

Important

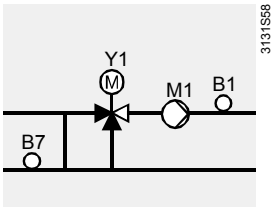
In the case of a room control combination with a ventilation system, the correct location of the sensors on the ventilation side must be observed.
Mounting the sensor for acquiring the room temperature in the extract air in combination with a heating circuit is not permitted!
The sensor for room temperature control of the ventilation system must be located in the room. If this is not observed, the heating circuit will operate with the wrong temperature when the ventilation plant is shut down.

10.4.2 Limitation of the return temperature

The heating circuit's mixing valve can be used for either maximum or minimum limitation of the return temperature, depending on the hydraulic system.



Maximum limitation



Minimum limitation

B1 Flow sensor
B7 Return sensor
M1 Heating circuit pump
Y1 Heating circuit mixing valve

Extra configuration

The function is to be activated via extra configuration:
> Heating circuit > Inputs > Return sensor Assign terminal
> Heating circuit > Functions > Type of return temp limitation

Settings

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Limitations

Operating line	*Range*	*Factory setting*
Return temperature min*	---- / 0…140 °C	----
Return temperature max*	--- (none) / 0…140 °C	----

* Displayed or hidden, depending on the type of limitation

Maximum limitation

If the return temperature exceeds the maximum value TRLmax, the heating circuit's flow temperature setpoint will be lowered. If the return temperature falls below the limit

value, the lowering of the flow temperature setpoint will be gradually reduced. The function operates with I-control action and an adjustable integral action time Tn.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Controller

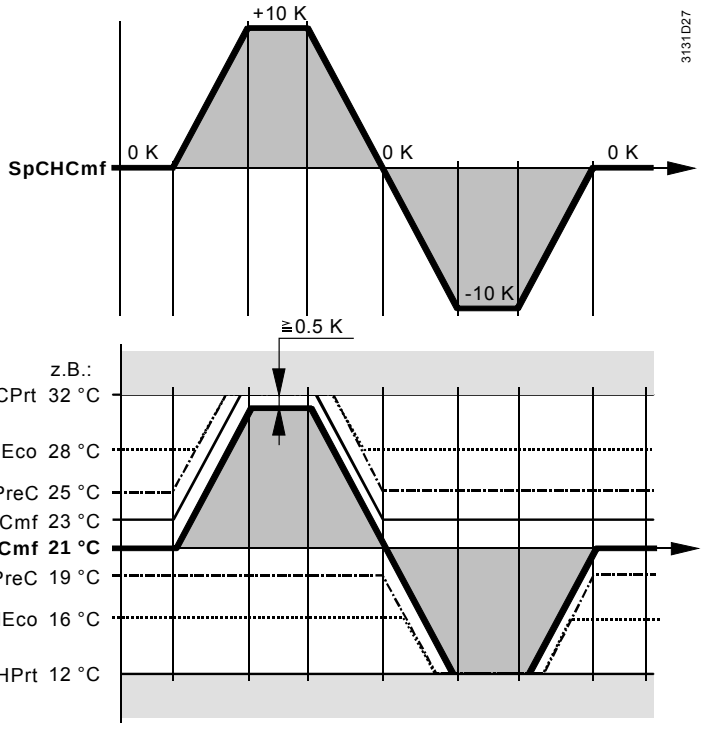
Operating line	*Range*	*Factory setting*
[Tn] return temp limitation max	0…60 min	30 min

Minimal limitation

Minimum limitation of the return temperature uses a fixed integral action time.

10.4.3 Room temperature setpoint adjuster, absolute

For the preselected room temperature setpoints, Comfort and Precomfort, a remote setpoint adjuster (e.g. BSG21.1) can be configured.
The 4 setpoints will be readjusted according to the following diagram.



C	Cooling	PreC	Precomfort
Cmf	Comfort	Prt	Protection
Eco	Economy	SP	Setpoint
H	Heating		

Extra configuration

The input is activated via the extra configuration:
Main menu > Commissioning > Extra configuration > Heating circuit > Inputs >
Room setpoint adjuster abs Assign terminal

Settings

There are no settings required.

Note

It is not recommended to use a QAA25 room temperature setpoint adjuster since its characteristic is not linear so that setpoint deviations of maximum 1 K would occur. Compensation is not possible.
The adjusted setpoint represents the Comfort setpoint. At the same time, the Precomfort setpoint is displaced parallel, which means that the difference between the 2 setpoints will be 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. For more detailed information, refer to section 10.5.2 “Room temperature setpoints”.

Extra configuration

The input is activated via the extra configuration:

Main menu > Commissioning > Extra configuration > Heating circuit > Inputs > Room setpoint adjuster rel Assign terminal

Settings

There are no settings required.

10.4.5 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

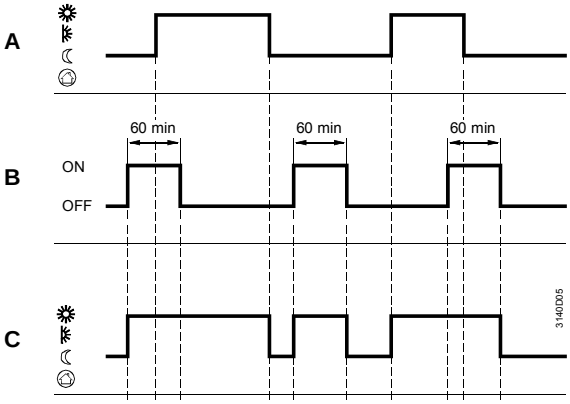
Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit > Space heating

Operating line	*Range*	*Factory setting*
Preselected room optg mode	Comfort / Precomfort / Economy / Protection	Comfort

10.4.6 Timer function

Using a configurable input, the edge of a signal triggered by a pushbutton can be acquired to extend Comfort mode in Auto mode. The timer’s time can be adjusted. The timer function becomes immediately active.



A Room operating mode according to the time switch

B Timer function

C Resulting 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

* This setting does not apply to the QAW740 room unit; in that case, the setting is made directly on the room unit

Tip

The activated timer can be stopped by changing the room operating mode (e.g. via the room operating mode selector).

10.4.7 Room control combination

The heating circuit of the RMK770 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 the underfloor heating system and 1 for the 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 RMU7… (P3140).

Extra configuration

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

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

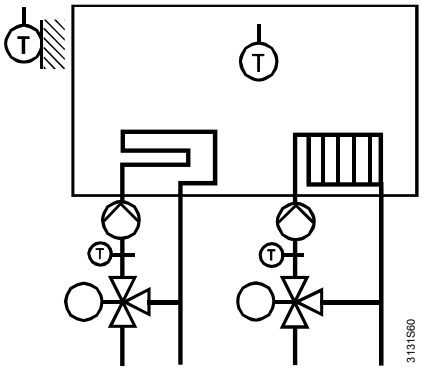
Main menu > Commissioning > Communication > Room heating circuit

Operating line	*Range*	*Factory setting*
Geographical zone (apartment)	1…126	1

Communication is described in chapter 13 ”Communication”.

Example with 2 heating circuits

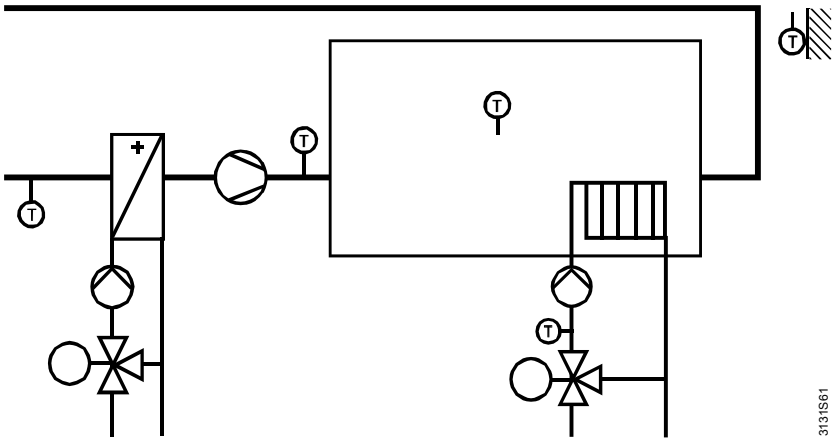
Problem:
The basic load is covered by a heating circuit with weather-compensated control and the load-dependent part by a second heating circuit with or without room influence. The 2 heating circuits shall operate in parallel and be controlled by a common switching program or a room operating mode selector.



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 10.6.4 “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.

10.5 Room operating modes and room temperature setpoints

10.5.1 Room operating modes

The room operating mode determines the preselected setpoint for the room temperature. The flow temperature setpoint, the heating limit and the optimization functions will be influenced depending on the current room temperature setpoint.

Room operating mode

■ Main menu > Heating circuit > Room operating mode

Operating line	*Range*	*Factory setting*
Preselection	Auto Auto Comfort Precomfort Economy Protection	Auto Auto
State	Comfort…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 10.5.5 "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 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 10.5.5 "Control priorities in the heating circuit").

Time switch

In Auto 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 > Holidays / Holidays/special days

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

Note

The holiday function is only active in Auto Auto mode.

10.5.2 Room temperature setpoints

Room temperature setpoints (settings)

The setpoints for the 4 room operating modes can be preselected by the plant operator via operation. The setting values limit each other.

Main menu > Heating circuit > 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	0…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).
The 4 setpoints are readjusted according to the following rules:

- Parallel readjustment of Comfort and Precomfort setpoint
- When the Economy setpoint is reached, it will be 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

10.5.3 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 / Morning boost / Boost heating + opt start / User requisition room /	

	User requisition external / Overtemp protec-tion/overrun / Plant operation selector / No requisition / Frost protection for the flow / Frost protection for the plant	

* Frost protection is ensured

Preselection

The heating circuit can be switched off for service purposes. On completion of pump overrun, the mixing valve will close and the heating circuit pump will be switched off. When preselecting “Off”, the internal frost protection function remains active.

⚠ After completion of service work, the selector must be set back to Auto .

State

The heating circuit’s present state (On / Off) is displayed.

Cause

It is indicated why the current state is active.

10.5.4 User requirements in the room

Overriding the 24-hour program

In Auto mode, the user can override the current 24-hour program and change to some other setpoint.
Following can be used for operation from the room:

- Switch or button (directly connected)
- Konnex operator devices (e.g. QAW740).

If room operating mode holidays is set to Protection, presence buttons and timer functions cannot be activated during the holiday period.

Room unit QAW740

Using the QAW740 room unit, the plant operator can select the room operating mode via the Mode button or Timer button.

Conventional switches and buttons

Messages from external switches or buttons can be read in via inputs. They override the other control interventions in accordance with the control priority.
The required inputs must be configured in the extra configuration.

Room operating mode contact

Using this contact, it is possible to switch to a room operating mode setpoint. This room operating mode is maintained as long as the contact is active.
The room operating mode can be selected on the service level.

Timer function

By pressing the button, Comfort mode can be selected for a certain period of time via this contact. The duration is fixed; the preselection can be adjusted on the service level.

Settings

The following settings define the mode of operation of the room operating mode contact and of the button for the timer function.

Main menu > Settings > Heating circuit > Space heating

Operating line	*Range*	*Factory setting*
Preselected room optg mode	Comfort / Precomfort / Economy / Protection	Comfort
Timer function*	0…720 min	60 min

* This setting also applies to the timer function via third-party Konnex devices

Third-party devices with Konnex interface

User interventions can also take place via a third-party device with Konnex interface.

Presence button

In Auto mode, the presence button is used to switch over the room operating mode until the time switch reaches the next switching point. Changeover takes place between Comfort or Precomfort and Economy mode.

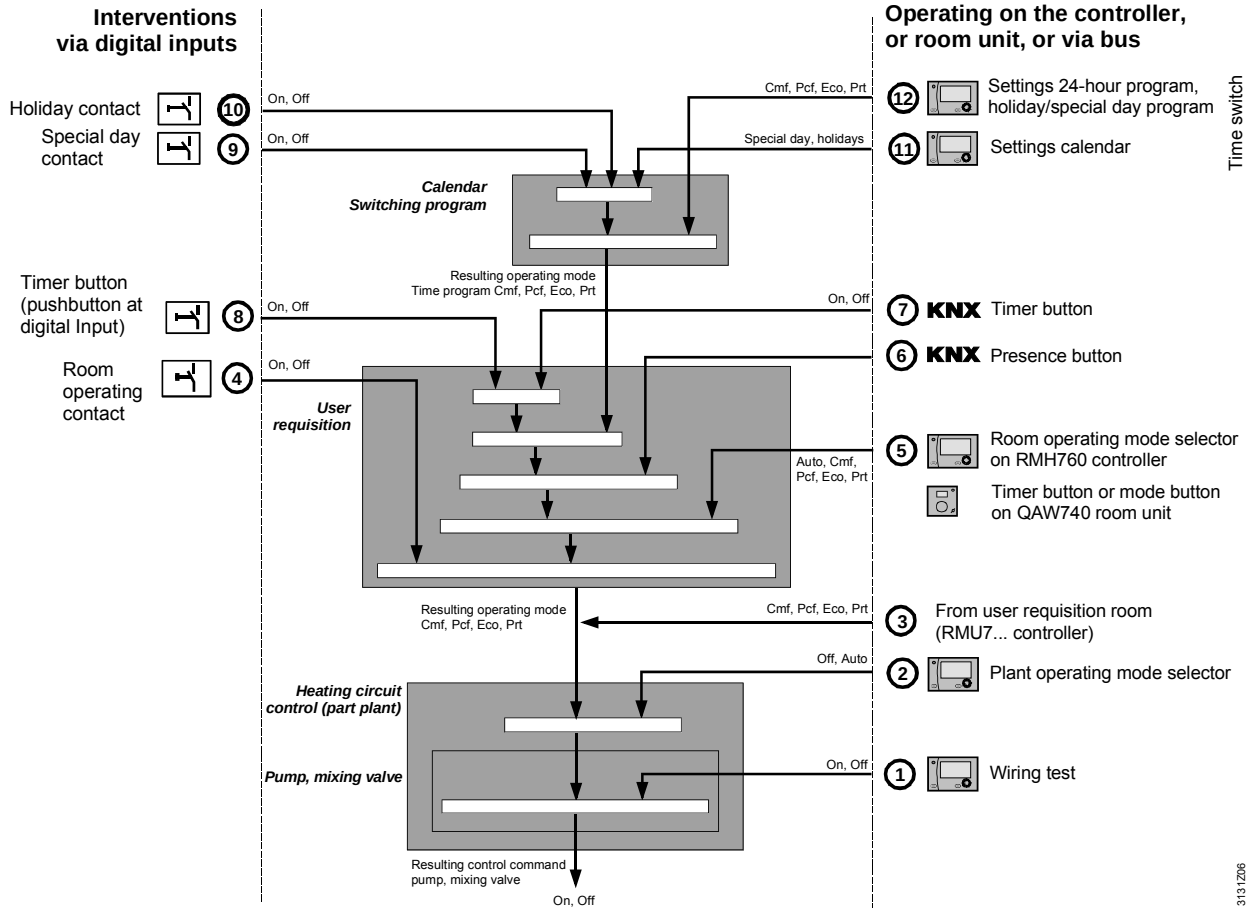
Timer function

The timer function is identical with triggering via a conventional button. This means that the setting used for the duration is also the same.

10.5.5 Control priorities in the heating circuit

The following illustration shows the priorities of the different interventions via digital inputs or via Konnex 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

Priority	*Name*	*Explanation*
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
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 Konnex device) can also override the room operating mode. If 2 or more functions are triggered, the function activated last will prevail.
⑨	Special day contact	The current 24-hour program gets overridden by the special day contact. The special day program is activated in the time switch
⑩	Holiday contact	The current 7-day program will be 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 will be activated. Holidays, if entered, will be 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 will be activated in accordance with the current weekday. The 24-hour program passes on the current room operating mode, the next setpoint, and the time up to the next switching point

10.6 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 by 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 has a delayed impact on the room. For this reason, the compensating variable used by the heating curve is not the actual but a 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)

For more detailed information, refer to subsection 10.6.3 “Influences on the flow temperature setpoint”.

10.6.1 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 %

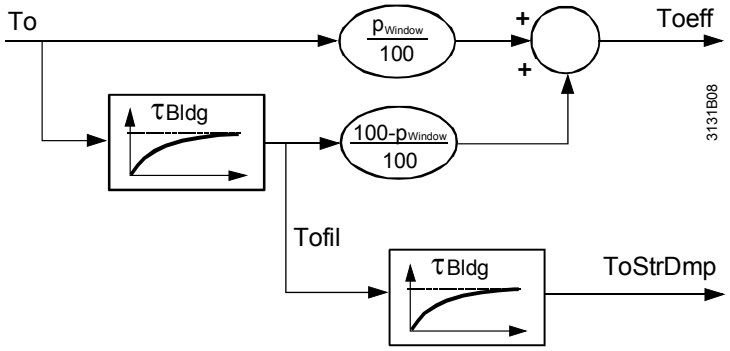
Composite outside temperature

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…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.

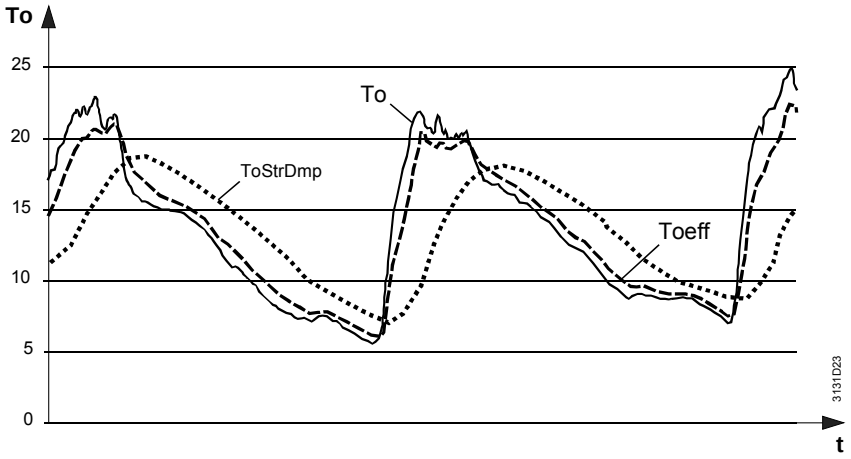


⇒ For the heating limit, the actual, the composite and the attenuated outside temperature are considered.

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 > Settings > Heating circuit > Space heating

Operating line	*Range*	*Factory setting*
Building time constant.	0…200 h	20 h

Heating curve

Main menu > Heating circuit > Heating curve

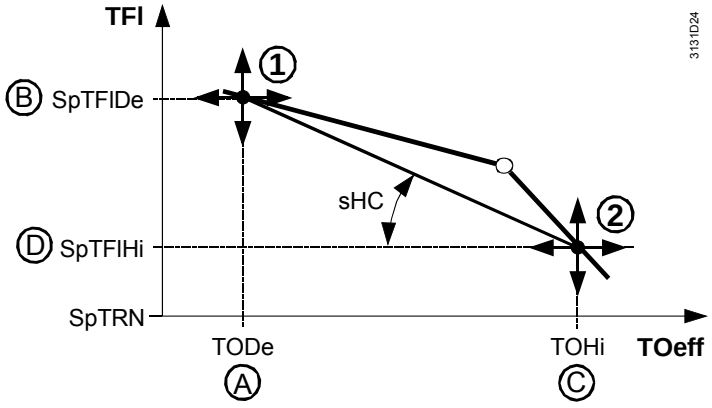
Operating line	*Range*	*Factory setting*
Proportion of windows	0…100 %	50 %

10.6.2 Heating curve

Curvepoints

The heating curve is defined by 2 curvepoints:
①: At the design temperature
- Outside temperature ToDe Ⓐ
- Flow temperature SpTFlDe Ⓑ

②: At the theoretical heating limit
- Outside temperature ToHi Ⓒ
- 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

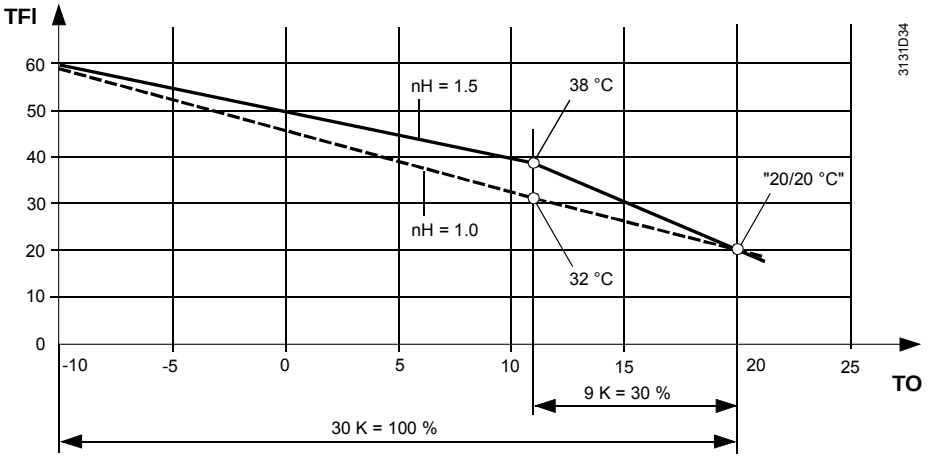
With a radiator exponent *nH* between 1…1.5, the heating curve is only slightly deflected and can therefore be replaced by linearized sections. This is achieved by setting another curvepoint, the so-called inflection point.
The inflection point lies 30 % below the outside temperature at which the flow 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 will be appropriately shifted (refer to subsection 10.6.3 “Influences 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:

$$\text{Lift} \approx (32\ °C - 20\ °C) \times (1.5 - 1) = 6\ K$$

Heating curve

■ Main menu > Heating circuit > Heating curve

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…10 °C	–11 °C
[Curvepoint 1] flow temp	25…140 °C	60 °C
[Curvepoint 2] outside temp	5…30 °C	15 °C
[Curvepoint 2] flow temp	5…140 °C	30 °C
Radiator exponent	1.00…2.00	1.30

Notes

The heating curve is identical to that of DESIGO.
Setting of the radiator exponent can be derived from the type of heating system and is based on physical ground.

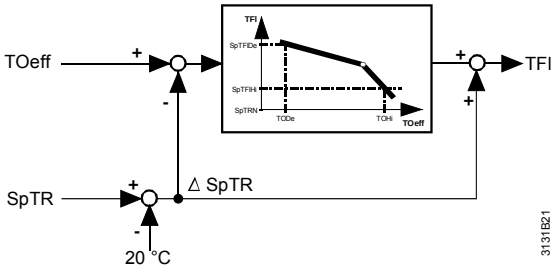
10.6.3 Influences on the flow temperature setpoint

Basis for the flow temperature setpoint is the heating curve. In addition, the setpoint is influenced by the following variables:

- Room setpoints
- Actual value room temp
- Morning boost (refer to subsection 10.8.3 “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 towards the outside temperature and a displacement by the same amount towards 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-Ni 1000 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!

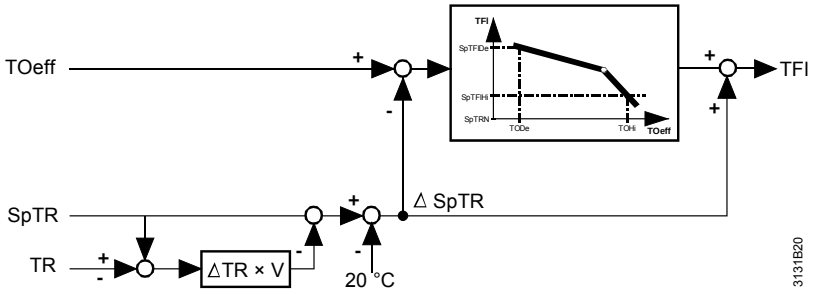
The set room influence defines the gain factor with which the room temperature deviation shall be weighted. The heating curve handles this amplified room temperature as a readjusted room temperature setpoint.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit > Optimizations/influences

Operating line	*Range*	*Factory setting*
Room influence	---- (none) / 0…10	----



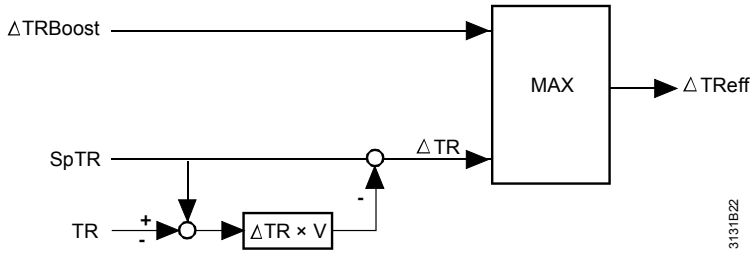
Rule of thumb

Due to the room temperature deviation ΔTV, the change of flow temperature setpoint corresponds roughly to the value of:

$$\Delta TFI = \Delta TR \times V \times (sHc + 1)$$

ΔTFI	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 resulting room temperature setpoint has a minimum limitation of 5 °C and a maximum limitation of 35 °C.

10.6.4 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 10.6.1 “The composite and the attenuated outside temperature”):

- The current outside temperature TO
- The composite outside temperature TOeff
- The attenuated outside temperature TOstrDmp

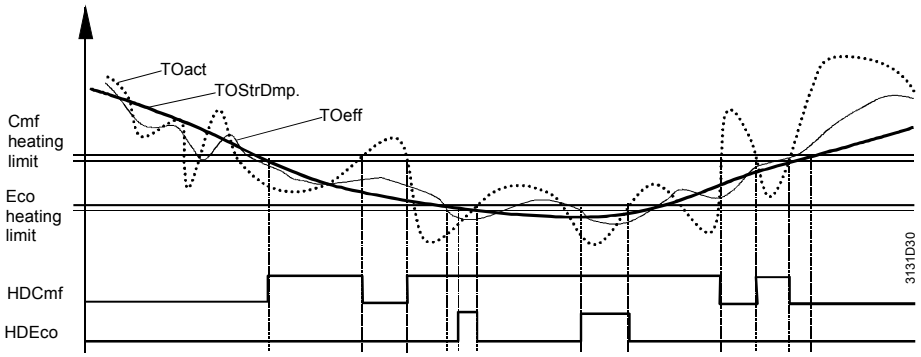
Comfort heating limit

- When **all 3** temperatures lie 1 °C **below** the Comfort heating limit, heat will be released in Comfort ☼ and Precomfort ☼ mode.
- When **1 of the 3** temperatures lies **above** the Comfort heating limit, the delivery of heat will be 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 RMU7… ventilation controller.

Economy heating limit

- When **all 3** temperatures lie 1 °C **below** the Economy heating limit, heat will be released in Economy ☾ and Protection ⓐ mode
- When **1 of the 3** temperatures lies **above** the Economy heating limit, delivery of heat will be locked



Settings

Main menu > Settings > Heating circuit > Space heating

Operating line	*Range*	*Factory setting*
Comfort heating limit	--- (none) / –5…25 °C	17 °C
Economy heating limit	--- (none) / –5…25 °C	5 °C

The following applies:

- If the Comfort heating limit is set to --- (none), there is a heating limit only in Economy ☾ and Protection ⓐ mode. There will be no changeover to summer operation
- If the Economy heating limit is set to --- (none), the Comfort heating limit acts in Economy ☾ and Protection ⓐ mode

Summer / winter operation (information for ventilation)

For operation in combination with the ventilation controller, summer / winter operation changeover is used as an overriding function.
When the attenuated outside temperature exceeds the Comfort heating limit, a change to summer operation will be made; this also applies to “Continuously Comfort ☼”.

10.7 Mixing valve control

10.7.1 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:

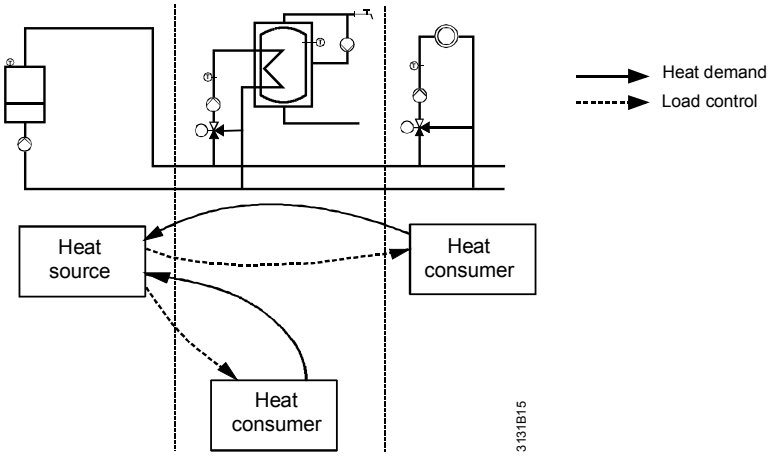
Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating circuit > Controller

Operating line	*Range*	*Factory setting*
Actuator running time	1…600 s	120 s
P-band Xp	1…100 K	48 K
Integral action time Tn	0…600 s	10 s

For more detailed information about mixing valve control and its setting aids, refer to section 5.7 “Mixing valve control”.

10.7.2 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 load maintenance.

10.8 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	0 h
Early shutdown max	00.00…06.00 h.min	00:00 h.min
Quick setback	Off / On	On
[Boost heating] setpoint increase	0…20 K	5 K
Room temperature rise	1…600 min/K	60 min/K

10.8.1 Type of optimization

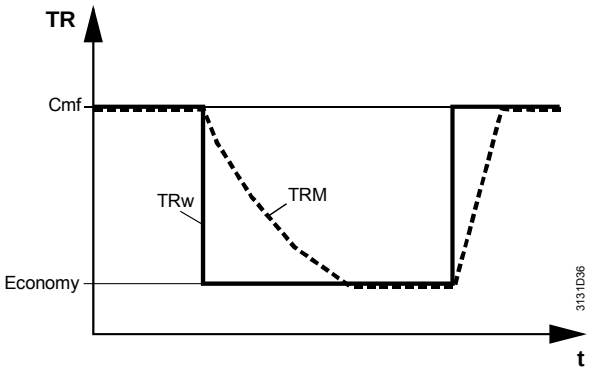
The type of optimization decides whether the optimization functions and boost heating shall be performed based on the measured room temperature or whether the room model shall be used.

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 will be updated at the rate of room temperature increase. In the case of sudden negative drops, the room model temperature will approach 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 > Settings > Heating circuit > Optimizations/influences

Operating line	*Range*	*Factory setting*
Type of optimization	With room model / With room temp sensor	With room model

10.8.2 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.
After the required room temperature is reached, the time differential to the entered time will be 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 will be deactivated.

Settings

Main menu > Settings > Heating circuit > Optimizations/influences

Operating line	*Range*	*Factory setting*
Forward shift on max	0…48 h	0 h
Room temperature rise	1…600 min/K	60 min/K

Optimum stop control

Optimum stop control switches the heating circuit off at the earliest possible point in time so that, when the time switch changes from Comfort ☼ or Precomfort ☼ to Econ-

omy ☼ 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 > 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 will be deactivated.

10.8.3 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 at the service level.

Settings

Main menu > Settings > Heating circuit > Optimizations/influences

Operating line	*Range*	*Factory setting*
Quick setback	Off / On	On

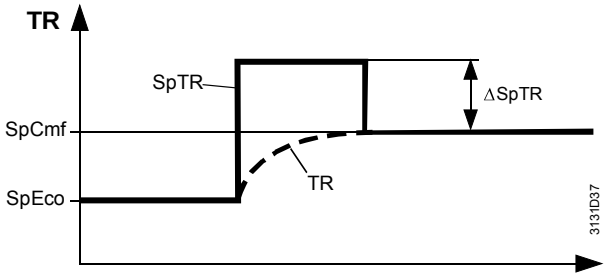
Quick setback is started when the room operating mode changes **from** Comfort ☼ or Precomfort ⊱ **to** Economy ☾ or Protection ⊛. The function will be terminated when the room temperature has reached the new setpoint or when a change back to Comfort ☼ mode is made.

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 will depend 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 will be active.
Morning boost will be 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 > Settings > Heating circuit > Optimizations/influences

Operating line	*Range*	*Factory setting*
[Boost heating] setpoint increase	0…20 K	5 K

10.9 Limit and protective functions

10.9.1 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.

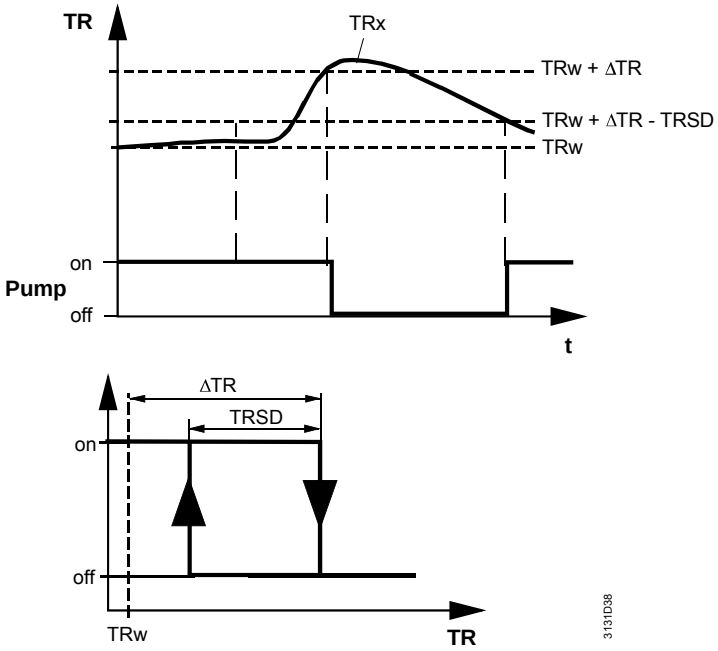
Deactivation

When the actual value room temperature has exceeded the room temperature setpoint by the adjustable room limitation increase, the heating circuit pump will be 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 will be switched on.



ΔTR Temperature differential for switching the heating circuit off
t Time
TR Room temperature
TRSD Temperature differential for switching the heating circuit on
TRw Room temperature setpoint
TRx Actual room temperature

Settings

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	0.2 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.

10.9.2 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 will be sent to the heat source and the mixing valve opens. The function will be terminated 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

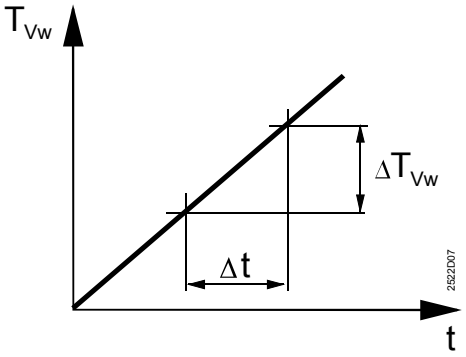
This setting ensures maximum limitation of the flow temperature setpoint.

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 increase: = $\Delta T_{Vw} / \Delta t$

t Time
Δt Unit of time
TVw Flow temperature setpoint
ΔTVw Rate of setpoint increase per unit of time

Settings

Main menu > Settings > Heating circuit > Limitations

Operating line	*Range*	*Factory setting*
Flow temperature max	0…140 °C	80 °C
Flow temperature min	---- (none) / 0…140 °C	----
Flow temperature rise max	---- (none) / 1…600 K/h	----
Frost protection for the plant	Off / On	On

10.9.3 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.

10.9.4 Pump kick and valve kick

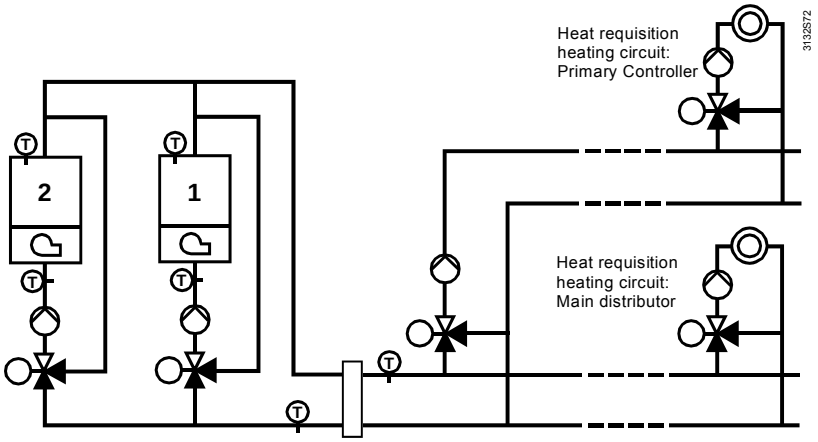
The pump kick is a protective function that is carried out periodically. It prevents pumps and / or actuators from seizing after longer off periods.

10.10 Heat demand

The internal heating circuit can be connected directly to the main distributor or after the primary controller (if 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 requisition for the current heat demand is calculated based on the flow temperature setpoint of the heating circuit (refer to subsections 10.6.2 “Heating curve” and 10.6.3 “Influences on the flow temperature setpoint”) plus an adjustable setpoint increase for the mixing valve.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Heating 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 requisition (to the boiler or the primary controller) shall be raised against the flow temperature setpoint.

10.11 Error 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 will be delivered.

The RMK770 has maximum 1 heating circuit. Index 1 indicates that the sensor error occurred in connection with this heating circuit.

Sensor error flow temperature

Number	*Text*	*Effect*
50	[HC 1] error flow sensor	Nonurgent message; must be acknowledged

In the event of a flow sensor error, the mixing valve will be driven to the fully closed position to become inactive (in case of a 3-position actuator); it can then be operated manually.

Sensor error, return temperature

Number	*Text*	*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 error, 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 error, 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

Error 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

No.	*Text*	*Effect*
2521	[Heat circuit pump] overload	
2522	[Heat circuit pump B] overload	
2523	[Heat circuit pump] no flow	
2524	[Heat circuit pump B] no flow	
2525	[Heating circuit pump] fault	

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 10.7 “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
Room setpoint absolute	…°C
Room setpoint relative	…°C
Actual value return temp	…°C
Return temperature max	…°C
Return temperature min	…°C
Room operating mode	
Timer function	
[Heating circuit pump] overload	0 / 1 (1 = overload)
[Heating circuit pump B] overload	0 / 1 (1 = overload)
Flow signal pump	

Outputs

Main menu > Heating circuit > Outputs

Operating line	*Adjustable values / remarks*
Heating circuit pump	Off / On
Heating circuit pump B	Off / On
Mixing valve 3-pos	0…100 %
Mixing valve modulating	Closing / ---- / Opening

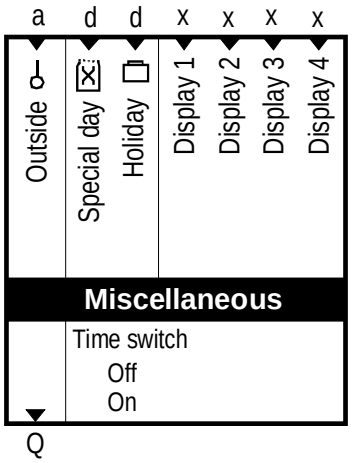
Limitations

Main menu > Heating circuit > Limitations

Operating line	*Adjustable values / remarks*
Flow temperature max	Off / On
Flow temperature min	Off / On
Flow temperature rise	Off / On
Return temperature min	Off / On
Return temperature max	Off / On

11 Function block miscellaneous

11.1 Function block overview



Inputs

Outside temperature sensor
Display input 1
Display input 2
Display input 3
Display input 4
Special day input
Holiday input

Outputs

Outside temperature relay

Functions

Time switch
Business card

11.2 Configuration

Function block “Miscellaneous” is automatically provided for all basic types. To activate the function block, no special basic configuration is required.

Extra configuration

The functions required for the plants can be activated in the extra configuration.

Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs

Inputs

Operating line	*Adjustable values / remarks*
Outside temperature	
Special day input	
Holiday input	
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*
Time switch	Off / On	Off
Business card	Yes / No	Yes

Note

The special day input and the holiday input are described in section 5.2 “Holidays/special days“.

Time switch

If there is no heating circuit on the controller, the heating circuit’s time switch can be used for external controllers on the bus.
For more detailed information, refer to section 5.1.2 “Time switch for external controllers on the bus”.

Business card

Activation of the business card is described in section 4.5.4 “Electronic business card“.

11.3 Outside sensor

At the RMK770, an outside sensor can be connected. It can be used for the following purposes:

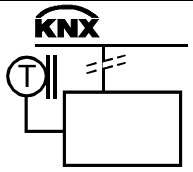
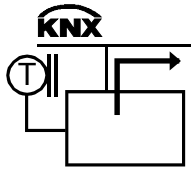
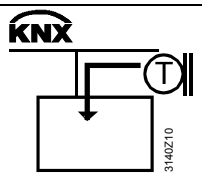
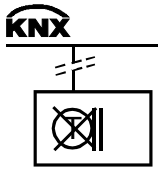
- Compensating variable for the heating circuit
- Compensating variable for the heat demand transformers
- For certain frost protection functions
- For locking the boilers as a function of the outside temperature

Connection choices

The outside temperature can be provided by different sources:

- It is locally connected to a terminal
- It is 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 > 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 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 temperatures 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 13 "Communication".

Configuration

Main menu > Commissioning > Communication > Distribution zones

Operating line	*Range*	*Factory setting*
Outside temperature zone	---- / 1…31	----

11.3.1 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.

11.3.2 Error 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, error message "Outside temp sensor error" will appear. Internally, the controller continues to operate using 0 °C as a backup value.

Error 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, error message ">1 outside temperature sensor" will be 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

11.4 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 3.4.8 “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 > Inputs > ...X...

Operating line	*Range*	*Factory setting*
Type reference	Ni1000 / 2×Ni1000 / T1 / Pt1000 / 0…10 V	Ni1000
Value low		
Value high		
Correction		
Normal position	Open / Closed	Open

The inputs can be assigned free text (maximum 20 characters).

Main menu > Commissioning > Settings > Texts

Operating line	*Range*	*Factory setting*
Display input 1	A…Z, a…z, 0…9, various punctuation marks, various special characters	
Display input 2	Like display input 1	
Display input 3	Like display input 1	

Operating line	*Range*	*Factory setting*
Display input 4	Like display input 1	

For detailed information about the configuration of analog inputs, refer to subsection 3.4.8 “Configuration of the universal inputs and outputs”.

11.5 Outside temperature relay

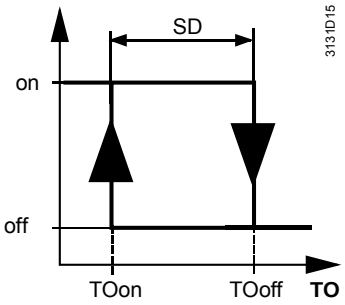
The function is to be activated via the extra configuration:

Main menu > Commissioning > Extra configuration > Miscellaneous > Outputs > Outside temperature relay Assign terminal

Settings

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 will be 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 will close when the outside temperature drops below 2 °C, it will open when the outside temperature exceeds 5 °C.

11.6 Diagnostic choices

Main menu > Miscellaneous > Inputs

Operating line	*Range*
Actual value outside temp	…°C
Special day input	0 / 1 (1 = closed)
Holiday input	0 / 1 (1 = closed)
Outside temperature simulation	…°C
Display input 1	
Display input 2	
Display input 3	
Display input 3	

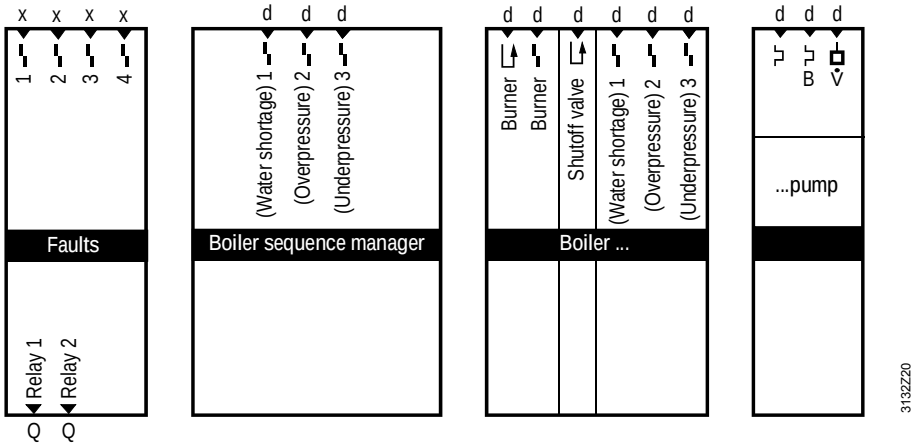
Main menu > Miscellaneous > Outputs

Operating line	*Range*
Outside temperature relay	Off / On

12 Function block faults

12.1 Function block overview

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.



12.2 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 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	
Fault relay 2	

12.3 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 error present
Button flashes	• There is an error which has not been acknowledged. After pressing the button, the button remains lit until the error has been rectified • There was a temporary error which, at the moment, can be no longer detected, demanding on acknowledgement which has not yet been made. After pressing the button, flashing stops
Button is lit	There is an error which has already been acknowledged

Fault relay

A fault relay, if present, remains energized as long as the button flashes.

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.

12.4 Fault properties

Faults are distinguished by their properties. There are faults with regard to:
- Acknowledgement and reset
- Signal priority
- Plant behavior

12.4.1 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 will be 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.

12.4.2 Signal priority

Priority urgent

Fault status messages are called urgent when correct operation of plant can no longer be ensured.
For example, “Error boiler temperature sensor” 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 “Loss of outside temperature“, for example.

12.4.3 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.

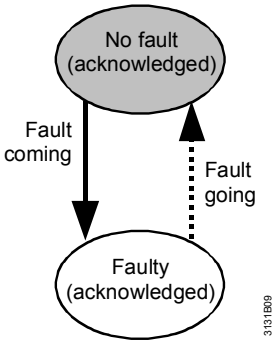
Examples

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	Both overload contacts of the twin pump are active. Urgent message; must be acknowledged and reset

12.5 State diagrams of the individual types of faults

Simple fault

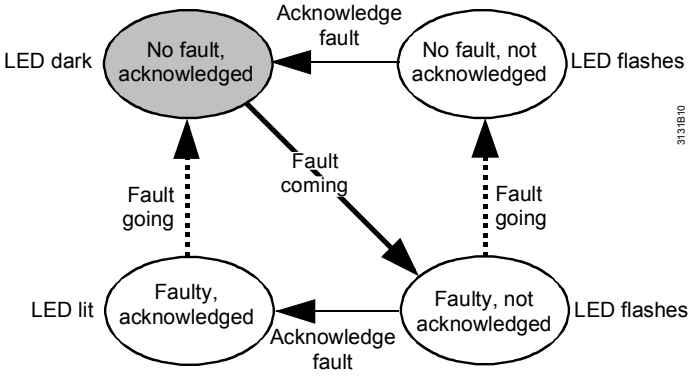
A simple fault need not be acknowledged. If there is a fault relay (see below), it must be reset, however.



When there is a simple fault, the LED is lit. When the fault is corrected, the LED will extinguish.
If a fault relay is configured, the LED flashes when the fault occurs and the relay is energized. When the fault button is pressed, the relay drops out and the LED extinguishes. When the fault is corrected, the LED will extinguish.

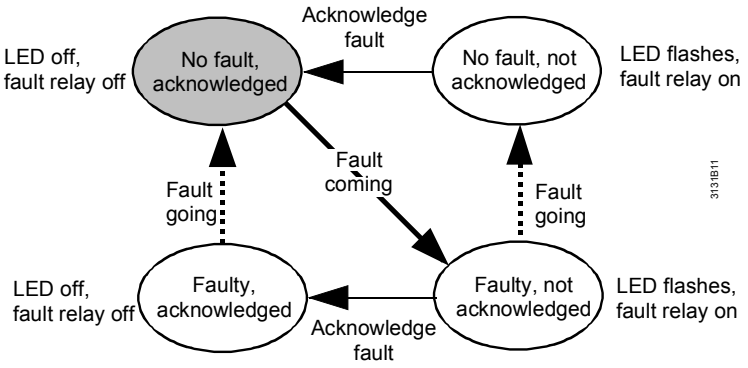
Standard fault

A standard fault must be acknowledged.



The LED flashes as long as the fault is not acknowledged. If the fault is still present, the LED will be lit after acknowledgement.

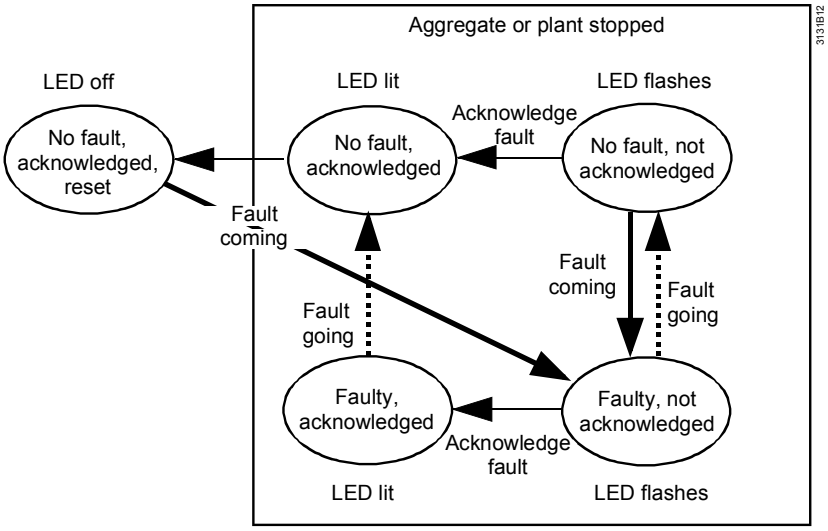
Standard fault with configured fault relay



Extended fault

Extended faults are faults that must be acknowledged **and** reset. This is the case with a twin pump, for example, when both pumps signal a fault. The pumps will start running

again only after the fault has been acknowledged, the errors corrected and the fault reset.



12.6 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.

12.7 Fault inputs

12.7.1 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 identifier

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 > 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 > Faults > Fault input...

Operating line	*Range*	*Factory setting*
Fault text	Free text, max. 20 characters	Aux 1
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 / Not urgent	Not urgent
Impact of fault	No stop / Stop	Stop
Limit value fault on	0 / 1*	1
Limit value fault off	0 / 1*	0

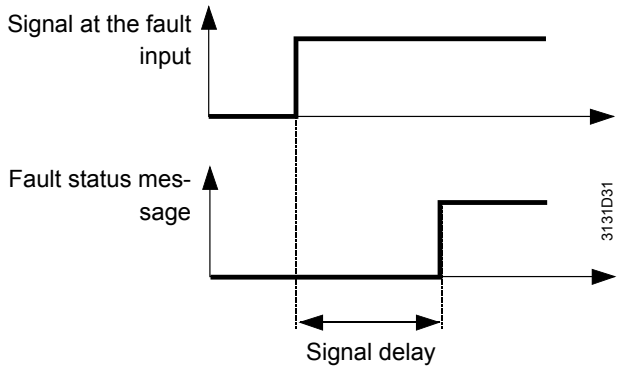
* Depends on “Input identifier”

These settings can only be made if the relevant input has previously been activated in the extra configuration.
For more detailed information, refer to section 12.4 “Fault properties”.

Fault text

The text for the universal status inputs is predefined with Aux 1 through Aux 4. 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.

Effect of fault

Parameter setting “Stop“ at the universal fault inputs means that the entire boiler sequence will be shut down.

Fault status messages

Number	*Text*	*Effect*
9001	Aux 1	Effect in accordance with the settings
9002	Aux 2	Effect in accordance with the settings
9003	Aux 3	Effect in accordance with the settings
9004	Aux 4	Effect in accordance with the settings

Error handling

The digital status inputs cannot be monitored. We recommend to use wiring ensuring that the signal drops out when a fault is pending.

12.7.2 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 a maximum flow temperature will not be exceeded.

Main menu > Commissioning > Settings > Faults > Fault input...

Operating line	*Range*	*Factory setting*
Limit value fault on	0 / 1*	1
Limit value fault off	0 / 1*	0

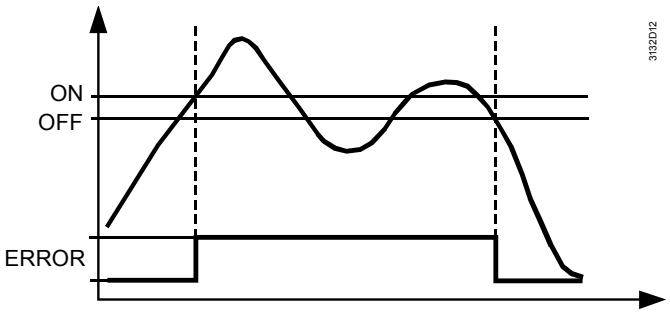
* Depends on “Input identifier”

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.

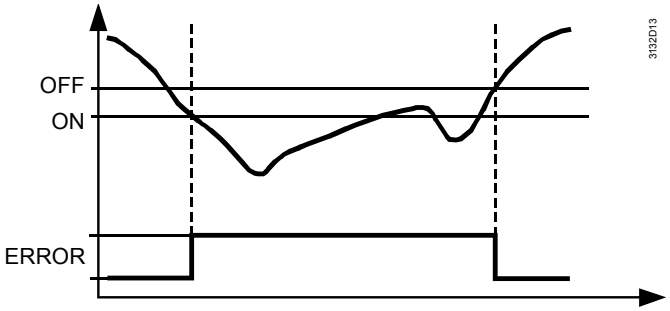


If “Limit value fault off“ is greater than “Limit value fault on”, the input is monitored for undershoot.

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.



12.8 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.

12.9 Fault relay

To pass on the fault status messages or to indicate them optically on a control panel, for example, 2 fault status outputs can be configured.

Extra configuration

The function is to be activated via the extra configuration:
For every relay, the following settings can be made:

- Fault priority: The priorities with which the relay shall pull in can be selected (refer to subsection 12.4.2 “Signal priority”)
- Fault source: When communication has been activated, the fault source can be set. The “Bus“ setting shows all faults signaled via bus.

Setting values

Main menu > Settings > Faults > Fault relay 1 (or 2)

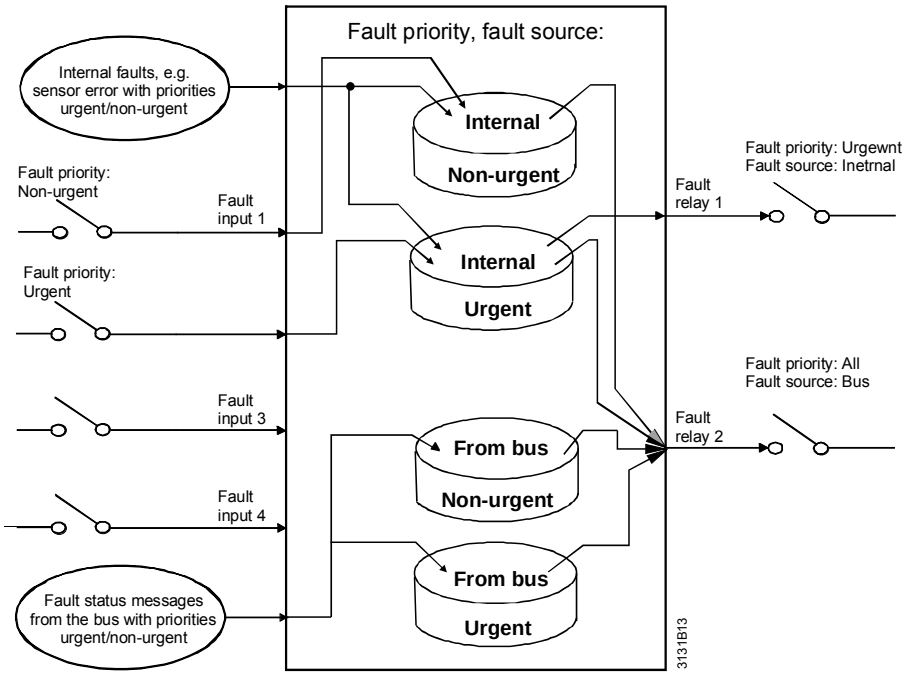
Operating line	*Range*	*Factory setting*
Fault priority	Urgent / Not urgent	Not urgent
Fault source	Internal / Bus	Internal

The fault relay only remains energized until the fault is acknowledged.
The fault button is lit until the fault is corrected.
The following illustration shows a possible configuration.

Example

Problem:
2 relays are configured as fault relay 1 and fault relay 2. Fault relay 1 shall indicate all internal fault status messages having the priority “urgent”. Fault relay 2 shall indicate all fault status messages (internal and from the bus), independent 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:



12.10 Alarm indication

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 each 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 each fault:

- Fault text
- Fault number
- Time of day and date the fault occurred

Fault status message bus

Here, the fault status message with the highest priority on the bus is displayed. In addition to the fault text, the fault number and the time of day and date the fault occurred, the device address of the faulty device will be 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	

12.11 Cancellation of all fault status messages

Using menu item “Delete faults”, the “Fault history” list can be canceled.

Functions

Main menu > Faults

Operating line	*Remarks*
Delete faults	Current faults will be reset, the ”Fault history“ list will be canceled

When activating this function, all other fault status messages will also be reset. Hence, only pending faults continue to be displayed.

Note

If the kind of acknowledgement with a pending fault is changed, it 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!

12.12 Functional 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 input 1	0 / 1 (0 = inactive, 1 = active)
Fault input 2	0 / 1 (0 = inactive, 1 = active)
Fault input 3	0 / 1 (0 = inactive, 1 = active)
Fault input 4	0 / 1 (0 = inactive, 1 = active)

In both the diagnostics and the wiring test, logic states are displayed. 1 indicates that the fault input is active. When selecting “Normal position open”, this is the case when

the contact is closed; when selecting “Normal position closed”, this is the case when the contact is open.

Main menu > Commissioning > Wiring test > Faults > Outputs

Operating line	*Remarks*
Fault relay 1	Off / On
Fault relay 2	Off / On

12.13 Diagnostic choices

Inputs

Main menu > Miscellaneous > Inputs

Operating line	*Range*
Fault input 1	0 / 1 (0 = inactive, 1 = active)
Fault input 2	0 / 1 (0 = inactive, 1 = active)
Fault input 3	0 / 1 (0 = inactive, 1 = active)
Fault input 4	0 / 1 (0 = inactive, 1 = active)

In both the diagnostics and the wiring test, logic states are displayed. 1 indicates that the fault input is active. When selecting “Normal position open”, this is the case when the contact is closed; when selecting “Normal position closed”, this is the case when the contact is open.

Outputs

Main menu > Miscellaneous > Outputs

Operating line	*Range*
Fault relay 1	Off / On
Fault relay 2	Off / On

Alarm indication

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

Faults > Faults Delete faults

Operating line	*Adjustable values / remarks*
Fault history will be deleted	

13 Communication

A detailed description of communication is given in Basic Documentation “Communication via Konnex 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.

13.1 Factory 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 informations > 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

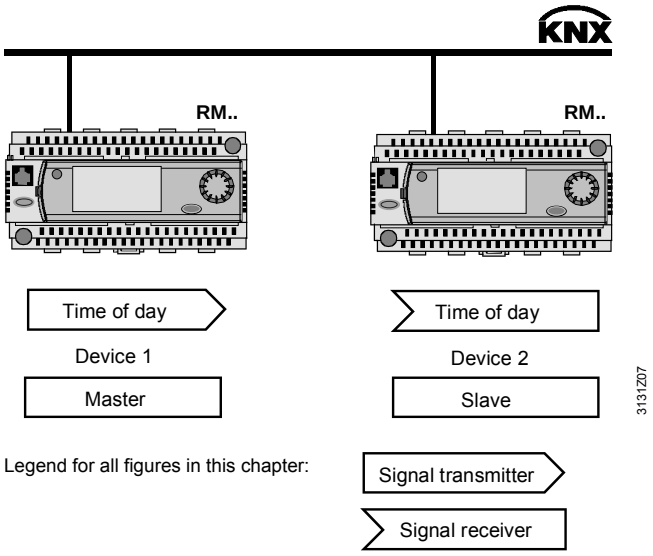
For small plants (maximum 8 devices), decentral power supply is adequate. This represents the factory setting). For detailed information, refer to Data Sheet “Konnex bus” (N3127) and Basic Documentation “Konnex communication” (P3127).

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 Konnex bus. The master then delivers the new time of day to all bus users. This means that for the user, operation is the same as on the clock master.



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.

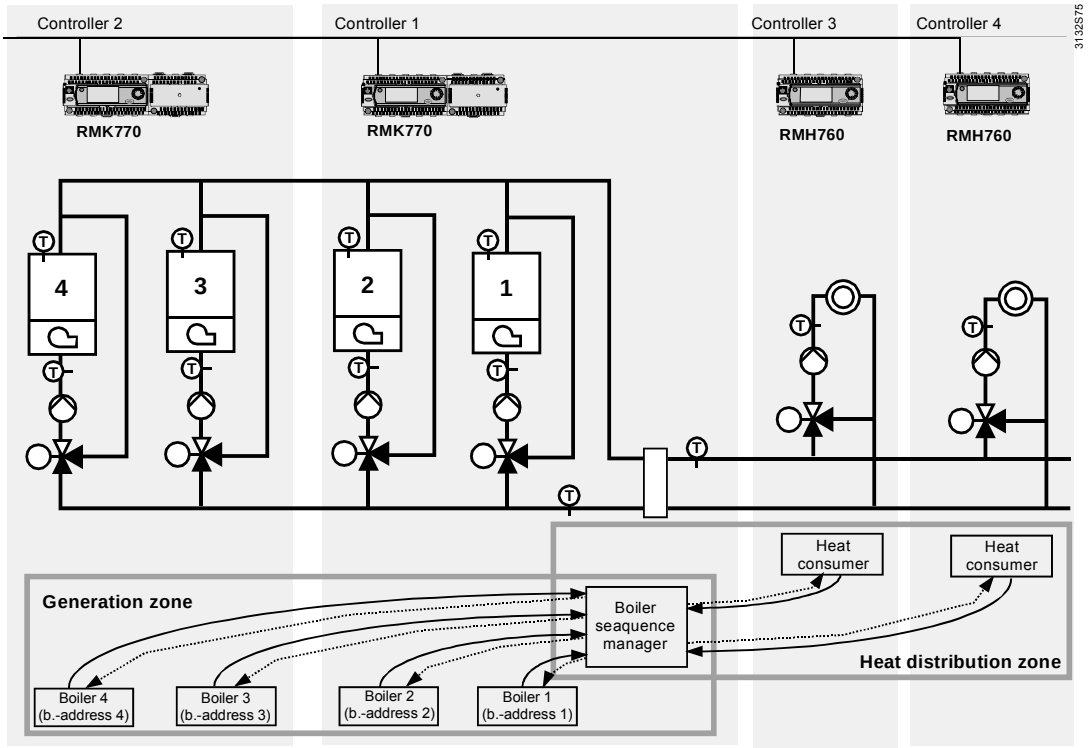
13.2 Generation zone and boiler sequence zone

For data exchange between the boiler sequence manager and the individual boilers, the 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. Typically, boiler sequence zone 1 is selected here.

Main menu > Commissioning > Communication > Generation zones

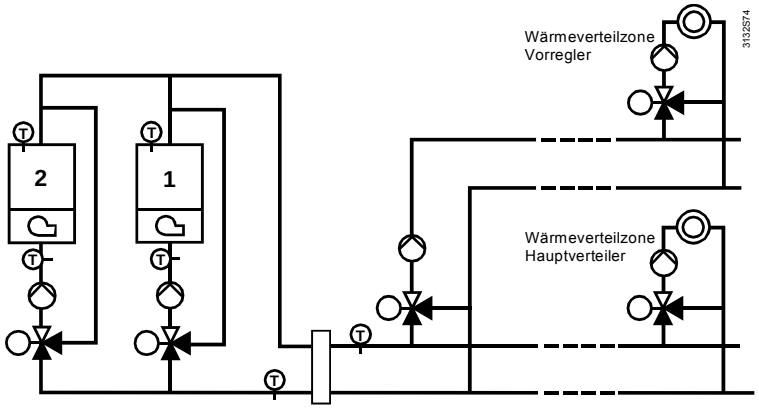
Operating line	*Range*	*Factory setting*
Boiler sequence zone	1…16	1
[Boiler 1] boiler address no	1…31 (RMK 1…6)*	1
[Boiler 2] boiler address no	1…31 (RMK 1…6)*	2
[Boiler 3] boiler address no	1…31 (RMK 1…6)*	3
[Boiler 4] boiler address no	1…31 (RMK 1…6)*	4
[Boiler 5] boiler address no	1…31 (RMK 1…6)*	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.

13.3 Distribution zones



13.3.1 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 distr zone main distributor	1…31	1
Heat distr zone prim controller	1…31	2
Outside temperature zone	---- / 1…31	----

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 distributor.
According to this differentiation, a heat distribution zone “Main distributor” and a heat distribution zone “Primary controller” 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 distributor 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

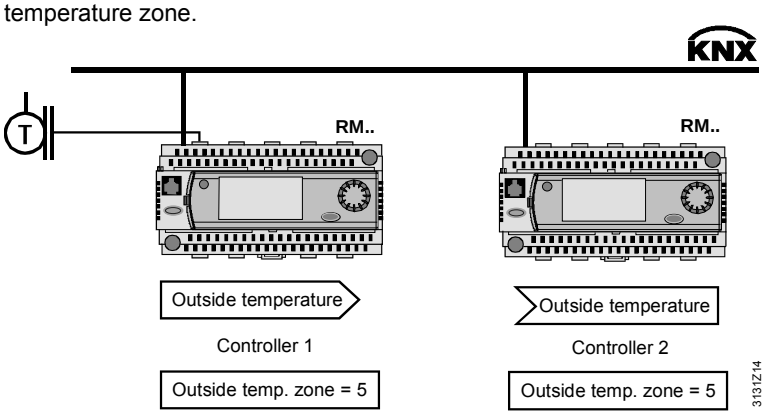
13.3.2 Outside temperature

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.

13.4 Setting the heating circuit room data and the holidays/special days

For a detailed description of the following settings, refer to Basic Documentation “Communication via Konnex bus" (P3137).

Main menu > Commissioning > Communication > Room-Heating circuit

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

Main menu > Commissioning > Communication > Holidays / Holidays/special days

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

13.5 Error handling

The RMK770 has maximum 1 heating circuit and 1 time switch. Index 1 indicates that the sensor error occurred on this plant.

Error code list

Number	*Text*	*Effect*
5000	No bus power supply	No bus power supply. Urgent message; must not be acknowledged
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
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
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
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

Number	*Text*	*Effect*
6001	>1 identical device address	More than 1 device with the same device address. Urgent message; must be acknowledged
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
5591	Failure boiler sequence manager	Nonurgent message; must be acknowledged
5592	>1 boiler sequence manager	Nonurgent message; must be acknowledged

14 Fault tracing support

If a fault is displayed, it is always practical to select operating line Faults > Faults current and look for any pending fault status messages before starting to rectify faults. If an extension module is faulty, that fault must always be rectified first because it may lead to a number of subsequential fault status messages.

14.1 Error code list

The RMK770 has maximum 1 heating circuit and 1 time switch. Index 1 indicates that the sensor error occurred on this plant.

Number	*Name*	*Possible cause, remarks*
10	Outside temp sensor error	Outside temperature sensor not connected, bus communication interrupted. Outside temperature zone not correctly set (transmitter and receiver must have the same outside temperature zone). Backup value is 0 °C. Nonurgent message; must not be acknowledged
11	>1 outside temperature sensor	More than 2 outside temperature sensors in the same outside temperature zone. Urgent message; must be acknowledged
12	Outs sensor simulation active	Simulation of the outside temperature is still active. Simulation of the outside temperature may only temporarily stay active. Nonurgent message; must not be acknowledged
50	[HC 1] flow sensor error	Nonurgent message; must be acknowledged
51	[HC 1] return sensor error	Error return temperature sensor heating circuit 1. Nonurgent message; must be acknowledged
57	Prim controller error flow sensor	Error primary controller flow temperature sensor. Nonurgent message; must be acknowledged
58	Prim controller error ret sensor	Error primary controller return temperature sensor. Nonurgent message; must be acknowledged
60	Room sensor error plant 1	Error room temperature sensor plant 1. Nonurgent message; must not be acknowledged
61	>2 room sensors in plant 1	More than 2 room temperature sensor for plant 1 in the same geographical zone. Urgent message; must be acknowledged
301	[Boiler 1] boiler sensor error	Error boiler sensor boiler 1
302	[Boiler 2] boiler sensor error	Error boiler sensor boiler 2
303	[Boiler 3] boiler sensor error	Error boiler sensor boiler 3
304	[Boiler 4] boiler sensor error	Error boiler sensor boiler 4
305	[Boiler 5] boiler sensor error	Error boiler sensor boiler 5

Number	*Name*	*Possible cause, remarks*
306	[Boiler 6] boiler sensor error	Error boiler sensor boiler 6
311	[Boiler 1] return sensor error	Error return sensor boiler 1
312	[Boiler 2] return sensor error	Error return sensor boiler 2
313	[Boiler 3] return sensor error	Error return sensor boiler 3
314	[Boiler 4] return sensor error	Error return sensor boiler 4
315	[Boiler 5] return sensor error	Error return sensor boiler 5
316	[Boiler 6] return sensor error	Error return sensor boiler 6
321	[B1] flue gas temp sensor error	Error flue gas temperature sensor boiler 1
322	[B2] flue gas temp sensor error	Error flue gas temperature sensor boiler 2
323	[B3] Flue gas temp sensor error	Error flue gas temperature sensor boiler 3
324	[B4] flue gas temp sensor error	Error flue gas temperature sensor boiler 4
325	[B5] flue gas temp sensor error	Error flue gas temperature sensor boiler 5
326	[B6] flue gas temp sensor error	Error flue gas temperature sensor boiler 6
330	Main flow sensor error	Urgent message; must be acknowledged and reset
331	Main return sensor error	Nonurgent message; must be acknowledged, no plant stop
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
1210	[Twin pump 1] fault	Contacts D1and D2 are active. Both fault inputs of the twin pump are active. Rectify error. Urgent message; must be acknowledged and reset
1225	[Twin pump 2B] overload	Contact D4 is active. Nonurgent message; must be acknowledged
2201	Heat requisition mod error	Error heat requisition DC 0…10 V. Nonurgent message; must not be acknowledged, no plant stop
2301	[B1 burner] no checkback signal	Urgent, must be acknowledged, aggregate stop of boiler 1
2302	[B2 burner] no checkback signal	Urgent, must be acknowledged, aggregate stop of boiler 2
2303	[B3 burner] no checkback signal	Urgent, must be acknowledged, aggregate stop of boiler 3
2304	[B4 burner] no checkback signal	Urgent, must be acknowledged, aggregate stop of boiler 4

Number	*Name*	*Possible cause, remarks*
2305	[B5 burner] no checkback signal	Urgent, must be acknowledged, aggregate stop of boiler 5
2306	[B6 burner] no checkback signal	Urgent, must be acknowledged, aggregate stop of boiler 6
2311	[B1 burner] no checkback signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 1
2312	[B2 burner] no checkback signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 2
2313	[B3 burner] no checkback signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 3
2314	[B4 burner] no checkback signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 4
2315	[B5 burner] no checkback signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 5
2316	[B6 burner] no checkback signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 6
2321	[Boiler 1] water shortage	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2322	[Boiler 2] water shortage	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2323	[Boiler 3] water shortage	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2324	[Boiler 4] water shortage	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2325	[Boiler 5] water shortage	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2326	[Boiler 6] water shortage	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2331	[Boiler 1] overpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2332	[Boiler 2] overpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2333	[Boiler 3] overpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2334	[Boiler 4] overpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2335	[Boiler 5] overpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2336	[Boiler 6] overpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)

Number	*Name*	*Possible cause, remarks*
2341	[Boiler 1] underpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2342	[Boiler 2] underpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2343	[Boiler 3] underpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2344	[Boiler 4] underpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2345	[Boiler 5] underpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2346	[Boiler 6] underpressure	Priority, effect and acknowledgement can be parameterized (default: urgent, boiler stop, must be acknowledged)
2351	[B1 valve] no check-back signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 1
2352	[B2 valve] no check-back signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 2
2353	[B3 valve] no check-back signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 3
2354	[B4 valve] no check-back signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 4
2355	[B5 valve] no check-back signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 5
2356	[B6 valve] no check-back signal	Urgent, must be acknowledged and reset, aggregate stop of boiler 6
2361	[B1] flue gas overtemperature	Priority and effect can be parameterized (default: not urgent, no boiler stop, must be acknowledged and reset)
2362	[B2] flue gas overtemperature	Priority and effect can be parameterized (default: not urgent, no boiler stop, must be acknowledged and reset)
2363	[B3] flue gas overtemperature	Priority and effect can be parameterized (default: not urgent, no boiler stop, must be acknowledged and reset)
2364	[B4] flue gas overtemperature	Priority and effect can be parameterized (default: not urgent, no boiler stop, must be acknowledged and reset)
2365	[B5] flue gas overtemperature	Priority and effect can be parameterized (default: not urgent, no boiler stop, must be acknowledged and reset)
2366	[B6] flue gas overtemperature	Priority and effect can be parameterized (default: not urgent, no boiler stop, must be acknowledged and reset)
2391	[Boiler seq] water shortage	Can be parameterized
2392	[Boiler sequence] overpressure	Can be parameterized

Number	*Name*	*Possible cause, remarks*
2393	[Boiler sequence] underpressure	Can be parameterized
2396	Main flow temp not reached	Not urgent message, must be acknowledged, no plant stop
2401	[B1 pump] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 1
2402	[B1 pump B] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 2
2403	[B1 pump] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 3
2404	[B1 pump B] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 4
2405	[Boiler 1 pump] fault	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 5
2406	[B1 pump] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 6
2411	[B1 pump] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 1
2412	[B2 pump] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 2
2413	[B3 pump] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 3
2414	[B4 pump] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 4
2415	[B5 pump] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 5
2416	[B6 pump] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 6
2421	[B1 pump B] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 1
2422	[B2 pump B] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 2
2423	[B3 pump B] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 3
2424	[B4 pump B] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 4
2425	[B5 pump B] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 5
2426	[B6 pump B] overload	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 6
2431	[B1 pump B] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 1
2432	[B2 pump B] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 2
2433	[B3 pump B] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 3
2434	[B4 pump B] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 4
2435	[B5 pump B] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 5
2436	[B6 pump B] no flow	Not urgent, must be acknowledged and reset, no aggregate stop of boiler 6

Number	*Name*	*Possible cause, remarks*
2441	[Boiler 1 pump] fault	Urgent, must be acknowledged and reset, aggregate stop of boiler 1
2442	[Boiler 2 pump] fault	Urgent, must be acknowledged and reset, aggregate stop of boiler 2
2443	[Boiler 3 pump] fault	Urgent, must be acknowledged and reset, aggregate stop of boiler 3
2444	[Boiler 4 pump] fault	Urgent, must be acknowledged and reset, aggregate stop of boiler 4
2445	[Boiler 5 pump] fault	Urgent, must be acknowledged and reset, aggregate stop of boiler 5
2446	[Boiler 6 pump] fault	Urgent, must be acknowledged and reset, aggregate stop of boiler 6
2491	[Main pump] overload	Nonurgent message; must be acknowledged and reset
2492	[Main pump B] overload	Nonurgent message; must be acknowledged and reset
2493	[Main pump] no flow	Nonurgent message; must be acknowledged and reset
2494	[Main pump B] no flow	Nonurgent message; must be acknowledged and reset
2495	[Main pump] fault	Urgent message; must be acknowledged and reset
2501	Primary controller Pump A Fault Overload	
2502	[System pump B] overload	
2503	[System pump] no flow	
2504	[System pump B] no flow	
2505	[System pump] fault	Urgent, must be acknowledged and reset
2521	[Heat circuit pump] overload	
2522	[Heat circuit pump B] overload	
2523	[Heat circuit pump] no flow	
2524	[Heat circuit pump [Heat circuit pump B] no flow	
2525	[Heating circuit pump] fault	
5000	No bus power supply	No bus power supply Urgent message; must not be acknowledged
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

Number	*Name*	*Possible cause, remarks*
5003	Invalid time of day	Time of day on clock time master must be readjusted. Reserve has elapsed. Nonurgent message; must not be acknowledged
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
5111	Syst time switch failure plant 2	Time switch master is missing or cannot be received. Nonurgent message; must not be acknowledged
5112	>1 time switch in plant 1	More than 1 time switch master in the same geographical zone. Nonurgent message; must be acknowledged
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 program master Nonurgent message; must be acknowledged
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
5411	Room master failure in plant 2	Room master for the room control combination for plant 1 is missing or cannot be received. Nonurgent message; must not be acknowledged
5591	Failure boiler sequence manager	Not urgent, no plant stop, must be acknowledged
5592	>1 boiler sequence manager	Not urgent, no plant stop, must be acknowledged
5593	Number of boilers wrong setting	Not urgent, must be acknowledged
5594	Invalid lead boiler	Not urgent, must not be acknowledged
6001	>1 identical device address	More than 1 device with the same device address. Urgent message; must be acknowledged
7101	Fault extension module	Extension module is missing, or in the wrong position, or faulty. Urgent message; must be acknowledged
9001	Aux 1	Fault input 1 active. Fault characteristics according to parameterization
9002	Aux 2	Fault input 2 active. Fault characteristics according to parameterization
9003	Aux 3	Fault input 3 active. Fault characteristics according to parameterization
9004	Aux 4	Fault input 4 active. Fault characteristics according to parameterization

14.2 Rectification of errors

Question	*Reply*
E.g., error message “[HC 1] error flow sensor“ appears although a sensor is connected.	Check to see if, in addition, error “Fault extension module“ occurred. This error can lead to the display of subsequential errors.
When commissioning the plant, the wrong language was selected. How do I find “my” language?	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.	A: The “Geographical zone“ of controller and room unit must agree. B: On the controller, the room operating mode is overridden by a function of higher priority. For more detailed information, refer to subsection 10.5.5 “Control priorities in the heating circuit”

15 Appendix

15.1 Configuration diagrams

Use

Use of the configuration diagrams is explained in subsection 3.3.5 “Use of configuration diagrams”.

15.1.1 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

15.1.2 Code letters

Capital letters

Physical inputs and outputs are marked with capital 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 N.O. contact)
Y	Analog output DC 0…10 V
3P	3-position output in pairs

Small letters

Internal signals are marked with small code letters:

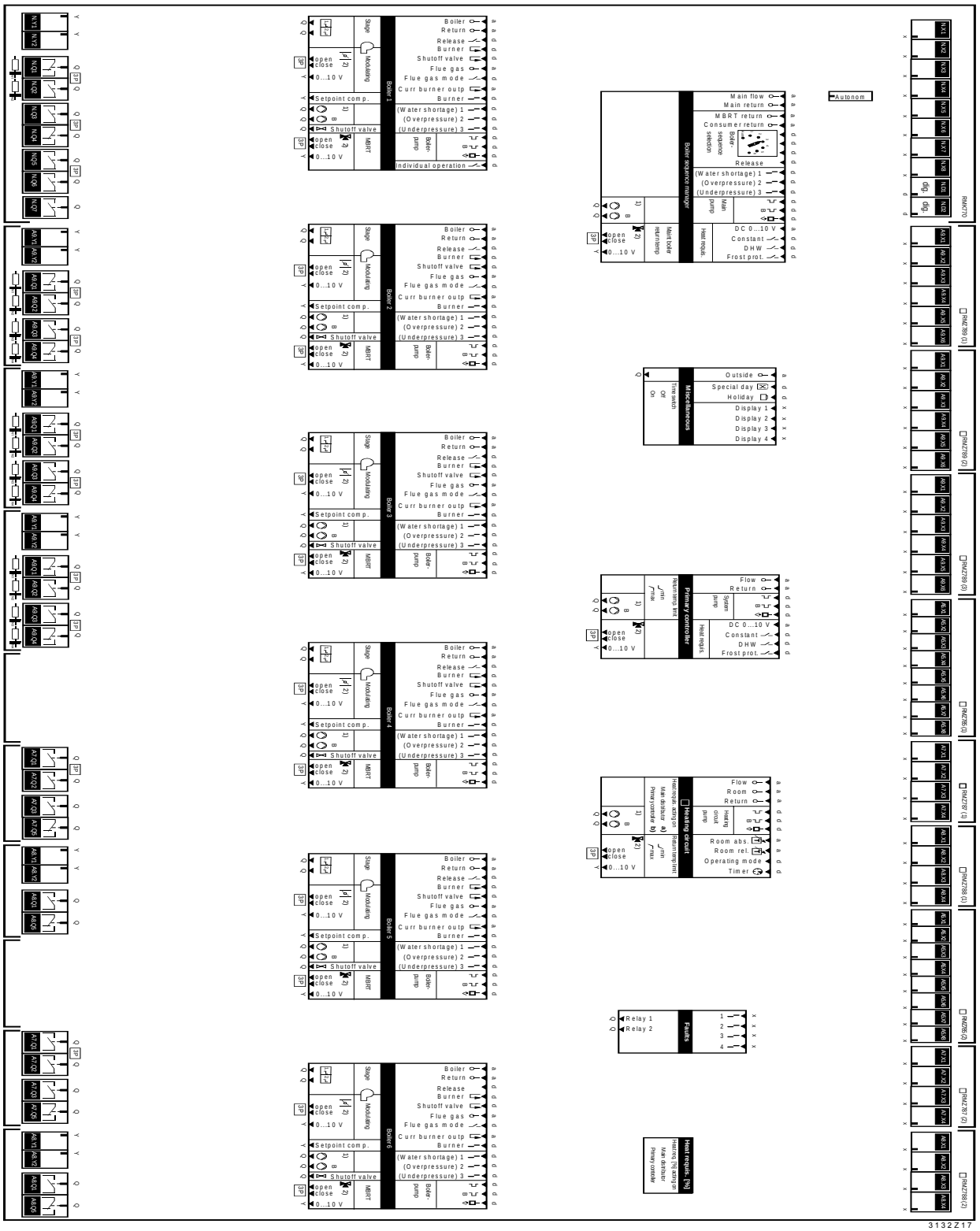
Code letter	*Explanation*
x	Analog or digital
a	Analog
d	Digital

15.1.3 Configuration choices

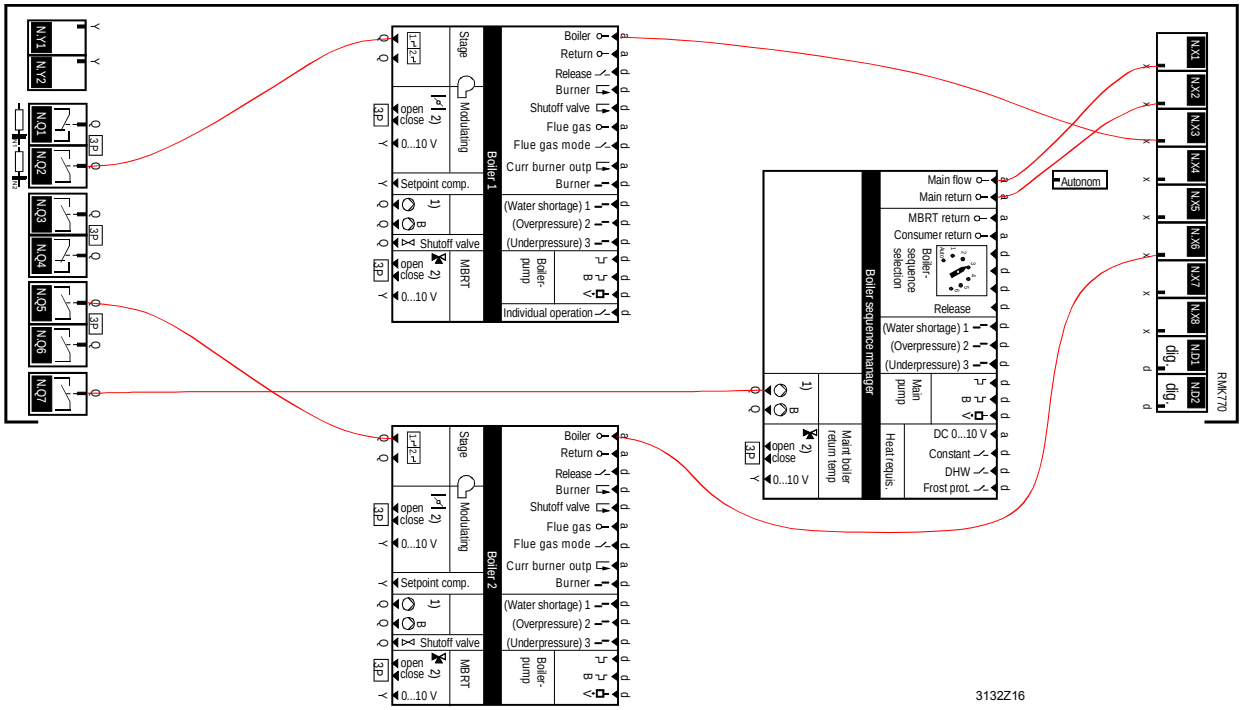
The maximum configuration is 3 extension modules, 7 single or twin pumps and 7 modulating outputs. The procedure for the configuration is always:

- from the arrow ▼ to the line ▌
- from capital letter to capital letter
- from small letter to small letter

15.1.4 Configuration diagram basic type K



15.1.5 Configuration diagram plant type K1.1



15.1.6 Menu tree

On the software side, all settings 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. Time switch
11. Heating circuit
12. Miscellaneous
13. Holidays/special day
14. Time of day/date
15. Faults
16. Settings
17. Device information
18. Data backup

Operating line	*Page*
1. Commissioning	**19**
Basic configuration	
Plant type	
Position 1	
Position 2	
Position 3	
Extra configuration	
Boiler sequence manager	
Inputs	
Main flow sensor	
Main return sensor	
MBRT return sensor	
Consumer return sensor	
Boil sequence selection input 1	
Boil sequence selection input 2	
Boil sequence selection input 3	
Release input	
Fault input 1	
Fault input 2	
Fault input 3	
[Main pump] overload	
[Main pump B] overload	
Flow signal pump	
Heat requis modulating	
Heat requisition 2-position	
DHW requisition 2-pos	
Frost prot requisition 2-pos	
Outputs	
Main pump	
Main pump B	
Maint boiler return temp 3-pos	
Maint boiler return temp mod	
Boiler 1	
Inputs	
Boiler sensor	
Return sensor	
Release input	
Checkb signal burner	
Checkb sign shutoff valve	
Flue gas temperature sensor	
Flue gas meas mode contact	
Current burner output	
Fault burner	
Fault input 1	
Fault input 2	
Fault input 3	
[Boiler pump] overload	
[Boiler pump B] overload	
Flow signal pump	
Individual operation (only at boiler 1!)	
Outputs	
Burner stage 1	

				Burner stage 2	
				Modulating burner 3-pos	
				Modulating burner mod	
				Setpoint compensation	
				Boiler pump	
				Boiler pump B	
				Shutoff valve	
				Maint boiler return temp 3-pos	
				Maint boiler return temp mod	
		Boiler 2 (same as boiler 1)			
		Boiler 3 (same as boiler 1)			
		Boiler 4 (same as boiler 1)			
		Boiler 5 (same as boiler 1)			
		Boiler 6 (same as boiler 1)			
		Primary controller			
			Inputs		
				Flow sensor	
				Return sensor	
				[System pump] overload	
				[System pump B] overload	
				Flow signal pump	
				Heat requis modulating	
				Heat requisition 2-position	
				DHW requisition 2-pos	
				Frost prot requisition 2-pos	
			Outputs		
				System pump	
				System pump B	
				Mixing valve 3-pos	
				Mixing valve modulating	
			Functions		
				Type of return temp limitation	
		Heat requisition [%]			
			Heat requisition [%] acting on		
		Heating circuit			
				Flow sensor	
				Room sensor	
				Return sensor	
				[Heat circuit pump] overload	
				[Heat cir twin pump B] overload	
				Flow signal pump	
				Room setpoint adjuster abs	
				Room setpoint adjuster rel	
				Room operating mode	
				Timer function	
			Outputs		
				Heating circuit pump	
				Heating circuit pump B	
				Mixing valve 3-pos	
				Mixing valve modulating	
			Functions		
				Type of return temp limitation	
				Room control combination	

		Miscellaneous			
			Input identifier		
				Display input 1	
				Display input 2	
				Display input 3	
				Display input 4	
			Inputs		
				Outside sensor	
				Special day input	
				Holiday input	
				Display input 1	
				Display input 2	
				Display input 3	
				Display input 4	
			Outputs		
				Outside temperature relay	
			Time switch		
			Business card		
		Faults			
			Input identifier		
				Fault input 1	
				Fault input 2	
				Fault input 3	
				Fault input 4	
			Inputs		
				Fault input 1	
				Fault input 2	
				Fault input 3	
				Fault input 4	
			Outputs		
				Fault relay 1	
				Fault relay 2	
	Settings				
	See “Main menu“ settings				
	Communication				
		Basic settings			
			Device address		
			Decentral bus power supply		
			Clock time operation		
			Remote setting clock slave		
			Remote reset of fault		
		Generation zones			
			Boiler sequence zone		
			[Boiler 1] boiler address no		
			[[Boiler 2] boiler address no		
			[Boiler 3] boiler address no		
			[Boiler 4] boiler address no		
			[Boiler 5] boiler address no		
			[Boiler 6] boiler address no		
		Distribution zones			
			Heat distr zone main distributor		
			Heat distr zone prim controller		
			Outside temperature zone		

		Room heating circuit		
			Geographical zone (apartment)	
			Time switch operation	
			Time switch slave (apartment)	
		Holidays/special day		
			Holidays/special day operation	
			Hol/spec day zone	
2. Boiler sequence manager				**74**
	Boiler sequence optg mode			
		Preselection		
		Setp preselection manual		
		Main flow temp actual value		
		State		
		Cause		
		Boil sequence selection manual		
	Boiler order			
		Number of available boilers		
		Address number lead boiler		
		Address number 1st lag boiler		
		Address number 2nd lag boiler		
		Address number 3rd lag boiler		
		Address number 4th lag boiler		
		Address number 5th lag boiler		
	Temperatures boilers 5…6			
		[Boiler addr no 1] actual value		
		[Boiler addr no 2] actual value		
		[Boiler addr no 3] actual value		
		[Boiler addr no 4] actual value		
		[Boiler addr no 5] actual value		
		[Boiler addr no 6] actual value		
	Inputs/setpoints			
		Main flow temp actual value		
		Main flow temp setpoint		
		Main return temp actual value		
		MBRT return temp actual value		
		MBRT return temp minimum		
		Consumer return actual value		
		Release input		
		Heat requis modulating		
		Heat requisition 2-position		
		DHW requisition 2-pos		
		Frost prot requisition 2-pos		
		Fault text		
		Fault input 1		
		Fault text		
		Fault input 2		
		Fault text		
		Fault input 3		
		[Main pump] overload		
		[Main pump B] overload		
		Flow signal pump		

	Outputs		
		Main pump	
		Main pump B	
		Maint boiler return temp 3-pos	
		Maint boiler return temp mod	
	Limitations		
		MBRT return temp minimum	
		Setpoint maximum limitation	
3. Boiler 1			**98**
	Flue gas measuring mode		
		Preselection	
		Flue gas meas mode contact	
		Release stage 2/modulation	
		Actual value boiler temperature	
		Flue gas temperature	
	Boiler operating mode		
		Preselection	
		State	
		Cause	
	Test mode		
		Preselection test mode	
		Boil setp test mode	
		Modulation value test mode	
		Actual value boiler temperature	
	Inputs/setpoints		
		Release input	
		Individual operation (only at boiler 1!)	
		Actual value boiler temperature	
		Boiler temperature setpoint	
		Actual value return temp	
		Return temperature min	
		Checkb sign shutoff valve	
		[Boiler pump] overload	
		[Boiler pump B] overload	
		Flow signal pump	
		Fault burner	
		Checkback signal burner	
		Burner hours run	
		Burner start counter	
		Current burner output	
		Flue gas temperature	
		Flue gas temperature maximum	
		Flue gas temperature limit value	
		Flue gas meas mode contact	
		Fault text	
		Fault input 1	
		Fault text	
		Fault input 2	
		Fault text	
		Fault input 3	
		Attenuated outside temp	
	Outputs		
		Burner stage 1	

		Burner stage 2	
		Modulating burner 3-pos	
		Modulating burner mod	
		Setpoint compensation	
		Boiler pump	
		Boiler pump B	
		Shutoff valve	
		Maint boiler return temp 3-pos	
		Maint boiler return temp mod	
	Limitations		
		Boiler temperature max	
		Boiler temperature min	
		Protective boiler startup	
		Boiler return temperature min	
		Burner run time min	
4. Boiler 2 (like boiler 1)			
5. Boiler 3 (like boiler 1)			
6. Boiler 4 (like boiler 1)			
7. Boiler 5 (like boiler 1)			
8. Boiler 6 (like boiler 1)			
9. Primary controller			**135**
	Plant operation		
		Preselection	
		State	
		Cause	
	Inputs/setpoints		
		Actual value flow temp	
		Flow temperature setpoint	
		Return temp actual value	
		Return temperature max	
		Return temperature min	
		Heat requis modulating	
		Heat requisition 2-position	
		DHW requisition 2-pos	
		Frost prot requisition 2-pos	
		[System pump] overload	
		[System pump B] overload	
		Flow signal pump	
	Outputs		
		System pump	
		System pump B	
		Mixing valve 3-pos	
		Mixing valve modulating	
	Limitations		
		Flow temperature max	
		Flow temperature min	
		Flow temperature rise	
		Return temperature max	
		Return temperature min	
10. Time switch			**58**
	Monday		
	Tuesday		
	Wednesday		

	Thursday		
	Friday		
	Saturday		
	Sunday		
	Special day		
11. Heating circuit			**145**
	Room operating mode		
		Preselection	
		State	
		Cause	
	Room setpoints		
		Comfort cooling setpoint	
		Comfort	
		Precomfort	
		Economy	
		Protection	
	Heating curve		
		[Curvepoint 1] outside temp	
		[Curvepoint 1] flow temp	
		[Curvepoint 2] outside temp	
		[Curvepoint 2] flow temp	
		Radiator exponent	
		Proportion of windows	
	Plant operation		
		Preselection	
		State	
		Cause	
	Inputs/setpoints		
		Composite outside temp	
		Attenuated outside temp	
		Actual value flow temp	
		Flow temperature setpoint	
		Room sensor temp	
		Actual value room temp	
		[Room temperature 1] bus	
		[Room temperature 2] bus	
		Room temperature model value	
		Current room temp setpoint	
		Room setpoint absolute	
		Room setpoint relative	
		Actual value return temp	
		Return temperature max	
		Return temperature min	
		Room operating mode	
		Timer function	
		[Heat circuit pump] overload	
		[Heat circuit pump B] overload	
		Flow signal pump	
	Outputs		
		Heating circuit pump	
		Heating circuit pump B	
		Mixing valve 3-pos	
		Mixing valve modulating	

	Limitations			
		Flow temperature max		
		Flow temperature min		
		Flow temperature rise		
		Return temperature max		
		Return temperature min		
12. Miscellaneous				**173**
	Inputs			
		Actual value outside temp		
		Outside temperature simulation		
		Special day input		
		Holiday input		
		Display input 1		
		Display input 2		
		Display input 3		
		Display input 4		
		Fault input 1		
		Fault input 2		
		Fault input 3		
		Fault input 4		
	Outputs			
		Outside temperature relay		
		Fault relay 1		
		Fault relay 2		
13. Holidays/special day				**60**
	Calendar			
		Entry 1		
		Entry 2		
		Entry 3		
	Room operating mode holidays			
	DHW operating mode holidays			
14. Time of day/date				**53**
	Time of day			
	Date			
	Year			
	Summer time start			
	Winter time start			
15. Faults				**178**
	Faults current			
		Fault 1…		
			Fault number	
	Fault history			
		Fault 1…		
			Fault number	
	Fault status message bus			
		Fault number		
	Delete faults			
16. Settings				
	Device			
		Language		
		Unit		
		Time format		
		Contrast		

	Inputs			
		Demand control		
			[Curvepoint 1] outside temp	
			[Curvepoint 1] flow temp	
			[Curvepoint 2] outside temp	
			[Curvepoint 2] flow temp	
			Flow temp correction max	
			Control mode	
			Requisition evaluation	
			Limit value requisition on	
			Limit value requisition off	
		Heat req boiler sequence		
			[Modulating] setpoint at 0 V	
			[Modulating] setpoint at 10 V	
			[Modulating] limit value	
			[2-pos] setpoint normal	
			[2-pos] setpoint DHW	
			[2-pos] setpoint frost prot	
		Heat req primary contr		
			[Modulating] setpoint at 0 V	
			[Modulating] setpoint at 10 V	
			[Modulating] limit value	
			[2-pos] setpoint normal	
			[2-pos] setpoint DHW	
			[2-pos] setpoint frost prot	
		RMK770.X1		
			Type reference	
			Type reference	
			Value low	
			Value high	
			Correction	
			Normal position	
		RMK770.X2		
			Type reference	
			Type reference	
			Value low	
			Value high	
			Correction	
			Normal position	
	Outputs			
		Outside temperature relay		
			Switch-off point	
			Switching differential	
		Setpoint comp boiler 1		
			Setpoint at 0 Volt	
			Setpoint at 10 Volt	
			Limit value	
		Setpoint comp boiler 2		
			Setpoint at 0 Volt	
			Setpoint at 10 Volt	
			Limit value	
		Setpoint comp boiler 3		
			Setpoint at 0 Volt	

			Setpoint at 10 Volt		
			Limit value		
		Setpoint comp boiler 4			
			Setpoint at 0 Volt		
			Setpoint at 10 Volt		
			Limit value		
		Setpoint comp boiler 5			
			Setpoint at 0 Volt		
			Setpoint at 10 Volt		
			Limit value		
		Setpoint comp boiler 6			
			Setpoint at 0 Volt		
			Setpoint at 10 Volt		
			Limit value		
	Boiler sequence manager				
		Number of boilers			
		Control parameters			
			Upward sequence integral		
			Downward sequence integral		
			Upward sequence delay		
			Shortened upward seq DHW		
			Downward sequence output limit		
			Boiler setpoint boost max		
			Changeover interval lead boiler		
			Changeover day		
			Changeover time		
			Lead boiler fixed		
			Boiler seq strategy		
			Setpoint boost main flow		
			Main pump operation lock signal		
		Twin pump			
			Run priority		
			Changeover period		
		Fault settings			
			Overload pump		
				Fault acknowledgement	
				Fault acknowledgement B	
			Fault input 1		
				Fault text	
				Impact of fault	
				Fault acknowledgement	
				Fault priority	
				Fault status signal delay	
			Fault input 2		
			Main flow supervision		
				Fault status signal delay	
		Sustained mode			
			Release main pump		
			Sustained mode setpoint		
		Limitations			
			Main flow setp max		
			MBRT return temp minimum		

			Lock sig maintained boil ret temp		
			Frost protection for the plant		
		Return control			
			Actuator run time		
			P-band Xp		
			Integral action time Tn		
	Boiler 1				
		Operation settings			
			Backup boiler		
			Outside temp lock limit value		
			Setpoint boost lag boiler		
			Switch-on delay pump		
			Switch-on delay burner		
			Boil setp individual operation (only at boiler 1!)		
			Boiler shutdown		
			Shutoff valve (MBRT)		
		Twin pump			
			Run priority		
			Changeover period		
		Fault settings			
			Checkb sign shutoff valve		
				Signal delay start	
			Fault burner		
				Fault acknowledgement	
			Checkback signal burner		
				Signal delay start	
				Signal interruption operation	
				Impact of fault	
			Overload pump		
				Fault acknowledgement	
				Fault acknowledgement B	
			Fault input 1		
				Fault text	
				Impact of fault	
				Fault acknowledgement	
				Fault priority	
				Fault status signal delay	
			Fault input 2		
				Fault text	
				Impact of fault	
				Fault acknowledgement	
				Fault priority	
				Fault status signal delay	
			Flue temp supervision		
				Flue gas temperature limit value	
				Impact of fault	
				Fault priority	
		Burner			
			Boiler switching differential		
			Burner run time min		
			Release limit stage 2		
			Reset limit stage 2		
			Locking time stage 2		

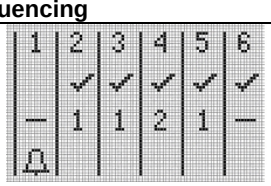
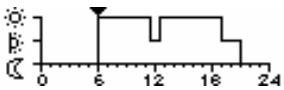
			Boiler output		
			Proportion stage 1		
		Limitations			
			Boiler temperature max		
			Boiler temperature min		
			Optimization min boiler temp		
			Boiler return temperature min		
			Consumer overrun time		
			Frost prot (release input off)		
			Frost prot boiler pump		
			Protective boiler startup		
			Protective boiler startup		
			Delta boiler temp max (stage 2)		
		Burner modulating			
			Actuator running time		
			P-band Xp		
			Integral action time Tn		
			Derivative action time Tv		
		Return control			
			Actuator running time		
			P-band Xp		
			Integral action time Tn		
	Boiler 2 (like boiler 1)				
	Boiler 3 (like boiler 1)				
	Boiler 4 (like boiler 1)				
	Boiler 5 (like boiler 1)				
	Boiler 6 (like boiler 1)				
	Primary controller				
		Primary controller			
			Setp boost primary controller		
		Twin pump			
			Run priority		
			Changeover period		
		Fault settings			
			Overload pump		
				Fault acknowledgement	
				Fault acknowledgement B	
		Limitations			
			Flow temperature max		
			Flow temperature min		
			Flow temperature rise max		
			Return temperature max		
			Return temperature min		
			System pump locking signal		
			Frost protection for the plant		
		Mixing circuit controller			
			Actuator running time		
			P-band Xp		
			Integral action time Tn		
			Locking signal gain		
			[Tn] return temp limitation max		
	Time switch				
		Time switch			

	Heating circuit			
		Heating circuit		
		Space heating		
			Comfort heating limit	
			Economy heating limit	
			Building time constant	
			Preselected room optg mode	
			Timer function	
		Optimizations/influences		
			Type of optimization	
			Forward shift on max	
			Early shutdown max	
			Quick setback	
			[Boost heating] setpoint boost	
			Room influence	
			Room temperature rise	
		Twin pump		
			Run priority	
			Changeover period	
		Fault settings		
			Overload pump	
				Fault acknowledgement
				Fault acknowledgement B
		Limitations		
			Room limitation boost	
			Room lim switching differential	
			Flow temperature rise max	
			Flow temperature max	
			Flow temperature min	
			Return temperature max	
			Return temperature min	
			Frost protection for the plant	
		Controller 1		
			Setp boost mixing valve	
			Actuator run time	
			P-band Xp	
			Integral action time Tn	
			[Tn] return temp limitation max	
			Response uncrit locking signals	
			Locking signal gain	
		Room setpoints		
			Comfort cooling setpoint	
			Comfort	
			Precomfort	
			Economy	
			Protection	
		Heating curve		
			[Curvepoint 1] outside temp	
			[Curvepoint 1] flow temp	
			[Curvepoint 2] outside temp	
			[Curvepoint 2] flow temp	
			Radiator exponent	
			Proportion of windows	

	Faults			
		Fault input 1		
			Fault text	
			Fault status signal delay	
			Fault acknowledgement	
			Fault priority	
			Impact of fault	
			Limit value fault on	
			Limit value fault off	
		Fault input 2		
			Fault text	
			Fault status signal delay	
			Fault acknowledgement	
			Fault priority	
			Impact of fault	
			Limit value fault on	
			Limit value fault off	
		Fault relay 1		
			Fault priority	
			Fault source	
		Fault relay 2		
			Fault priority	
			Fault source	
	Protective functions			
		Frost prot for plant ON (cycling)		
		Frost prot for plant ON (cont)		
		Kick day		
		Kick time		
		Pump/valve kick		
	Texts			
		Device name		
		File name		
		Display input 1		
		Display input 2		
		Display input 3		
		Display input 4		
		Business card line 1		
		Business card line 2		
		Business card line 3		
		Business card line 4		
17. Device information				**48**
18. Data backup				**47**

15.2 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
	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
	Return temperature max
	Return temperature min
Time switch	
	 (Example)
Heating circuit	
	Preselection
	State
	Cause
Heating circuit	
	Actual value room temp
	Current room temp setpoint
	Actual value flow temp
	Flow temperature setpoint

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 signal bus	
	Fault number
	Device address
Service information	

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