

### Installation

#### Place of installation

- In a dry room, e.g. the boiler room
- Installation choices:
  - Control panel (in the panel front, on the inner wall, or on a DIN rail)
  - Control cabinet
  - Sloping front of a control desk
- Permissible ambient temperature: 0...50 °C

#### Electrical installation

- The local regulations for electrical installations must be complied with
- Cable strain relief must be ensured
- Cables from the controller to the actuators and pumps carry mains voltage
- Sensor cables should not be run parallel to mains carrying cables
- To protect the solar collector sensor from voltage surges (caused by lightning for example), the separately available conduit box for overvoltage protection (AGS2S.200/109) should be installed

#### Permissible cable lengths

- For all sensors, thermostats and external contacts:
 

Copper cable 0.6 mm dia.	max. 20 m
Copper cable 1.0 mm <sup>2</sup>	max. 80 m
Copper cable 1.5 mm <sup>2</sup>	max. 120 m
- For room units:
 

Copper cable 0.25 mm <sup>2</sup>	max. 25 m
Copper cable 0.5 mm <sup>2</sup>	max. 50 m
- For the data bus:
 

0.75...2.5 mm <sup>2</sup>	according to Data Sheets N2030E and N2032E
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#### Mounting and wiring the base

##### Wall mounting

1. Separate base from the controller.
2. Hold base against the wall. Marking TOP must be at the top!
3. Mark fixing holes on the wall.
4. Drill holes.
5. If required, knock out holes on the base for the cable entry glands.
6. Screw base to the wall.
7. Wire up the base.

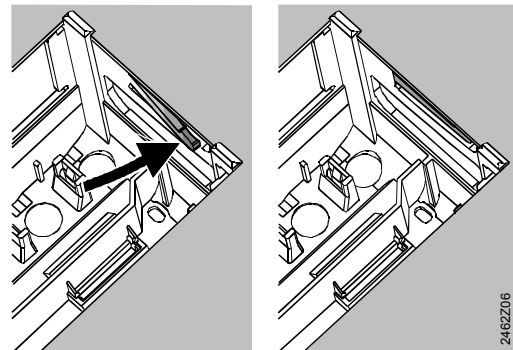
##### DIN rail mounting

1. Fit rail.
2. Separate base from the controller.
3. If required, knock out holes on the base for the cable entry glands.
4. Fit base to the rail. Marking TOP must be at the top!
5. If required, secure the base (depending on the type of rail).
6. Wire up the base.

##### Flush panel mounting

- Panel cutout required: 92 x 138 mm
- Maximum thickness: 3 mm

1. Separate base from the controller.
2. If required, knock out holes on the base for the cable entry glands.
3. Insert base in the panel cutout from behind until stop is reached. Marking TOP must be at the top!
4. Push lateral tongues behind the front panel (refer to illustration below).



Wrong

Correct

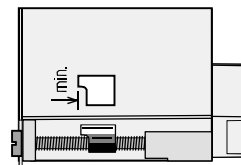
Place tongues on both sides correctly – they may not be located inside the cutout!

5. Wire up the base. Make sure the cable lengths are such that there is sufficient space to open the control panel door.


### Commissioning





#### Preparatory checks

1. DO NOT switch on power yet.
2. Check wiring according to the plant connection diagram.
3. Ensure correct position and location of the levers by turning the fixing screws (refer to illustration on the lateral wall of the unit).









4. Insert controller in the base until stop is reached. Marking TOP must be at the top!
5. Tighten fixing screws alternately.
6. Check the motorized valves: See if
  - they are correctly installed (observe direction of flow as indicated on the valve body)
  - the manual lever is disengaged.
7. Note with underfloor and ceiling heating systems: The limit thermostat must be correctly adjusted. During the functional test, the flow temperature may not exceed the maximum permissible level (usually 55 °C). If it does, proceed immediately as follows:
  - Either close the valve manually, or
  - Switch off the pump, or
  - Close the pump isolating valve

8. Switch on power. The display must show something (e.g. time of day). If not, the reason may be one of the following:
  - No mains voltage
  - Main fuse blown
  - Mains isolator or main switch not set to ON
9. If one of the operating mode buttons flashes, a room unit or contact H1 overrides the controller. Select operating mode  on the room unit; switch off contact H1.

Press  and  to select the next line block above.  
 Press  and  to select the next line block below.

### General information about operation

- Setting elements:
  - Setting knob
  - Display; an operating line is assigned to each setting
  - Buttons for selecting and adjusting setting values:
    -  Next operating line below
    -  Next operating line above
    -  Decrease the displayed value
    -  Increase the displayed value
- Adopting a setting value:  
 The setting value is adopted by selecting the next operating line (or by pressing one of the operating mode buttons)
- Entering --- / --:-- / --- (deactivating a function):  
 Keep  or  depressed until the required display appears
- Block jump function:  
 To select a single operating line quickly, 2 button combinations can be used:

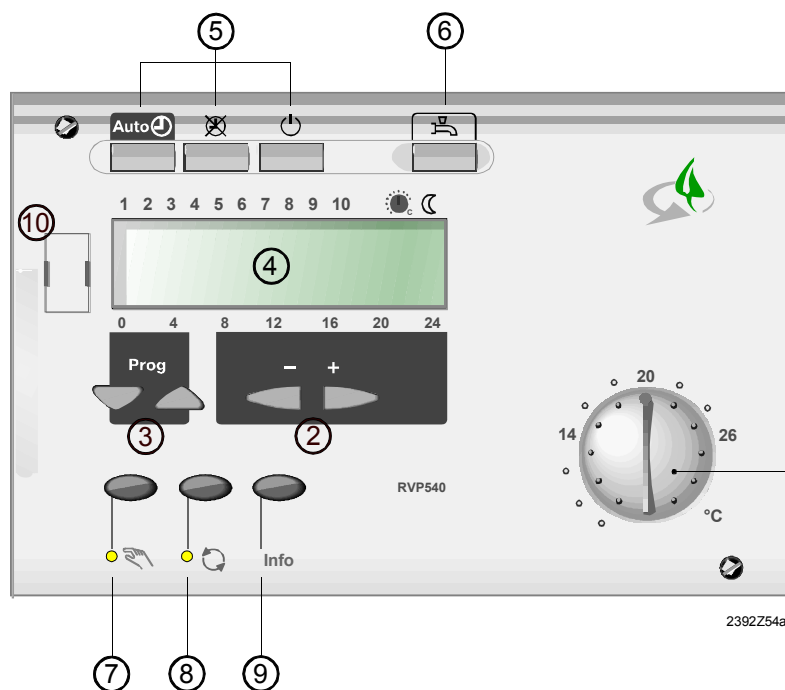
### Setting procedure







1. Make settings on the operating lines according to the instructions provided by your local Siemens HVAC Products sales office.
2. Select plant type on operating line 100.
3. Make the required settings on the controller. All functions and operating lines required for the selected type of plant will be activated and can be set. Operating lines that are not used will be hidden.
4. Enter the adjusted values in the table!
5. Set the general functions (independent of the type of plant).

### Commissioning and functional check

- Specific operating lines for the functional check:
  - 200 = output test
  - 201 = input test
  - 296 = functional test oil- / gas-fired boiler
  - 345 = functional test solar
  - 395 = functional test wood-fired boiler
  - 545 = functional test d.h.w. storage tank
  - 745 = functional test heating circuit
  - 888 = output test P1
  - 894 = output test Ux
- If **Er** (ERROR) appears on the display: Refer to operating line 50 to find the fault

### Operating elements



- ① Room temperature setpoint knob  
Adjustment of nominal room temperature setpoint
- ② Setting buttons  
Parameter settings (+ / -)
- ③ Operating line selection buttons (Prog)  
Selection of parameters / switching operating lines
- ④ Display  
Showing actual values and settings
- ⑤ Operating mode buttons heating circuit  
Operating mode changes to:  
 Automatic operation  
 Continuous operation  
 Standby
- ⑥ Operating mode button d.h.w.  
 D.h.w. heating ON / OFF  
 Manual d.h.w. push
- ⑦ Function button with LED for manual operation  
 Manual operation ON / OFF
- ⑧ Green button with signal lamp  
 Green operation ON / OFF
- ⑨ Info button  
Display of plant values
- ⑩ Connection facility for PC tool  
Diagnostics and service with OC169 / ACS69

An illuminated button or signal lamp indicates that the relevant function is activated.

Front of RVP540 and RVP550

## Connection diagrams

### Markings of connection terminal on the low-voltage side

Terminal	Terminals
M	Ground
Ux	Output DC 0...10 V
P1	PWM output
B109	Temperature sensor
M	Ground sensors
B108	Temperature sensor
B107	Temperature sensor
B106	Temperature sensor
M	Ground sensors
B105	Temperature sensor

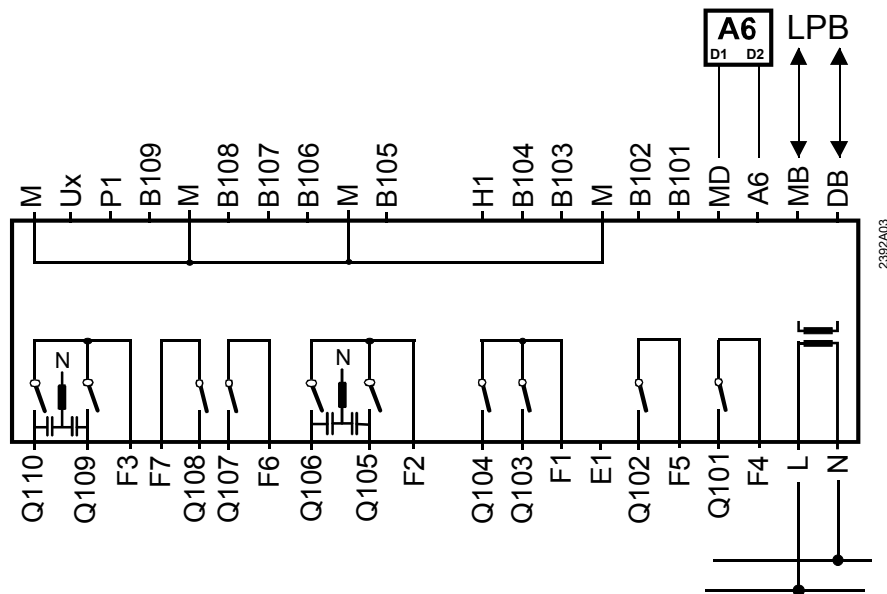
Terminal	Terminals
H1	Input H1 (contact or DC 0...10 V)
B104	Temperature sensor
B103	Temperature sensor
M	Ground sensors
B102	Temperature sensor
B101	Temperature sensor NTC / LG-Ni 1000 with automatic identification
MD	Ground PPS (room unit, BMU)
A6	Data PPS (room unit, BMU)
MB	Ground bus (LPB)
DB	Data bus (LPB)

### Markings of connection terminal on the mains voltage side

Terminal	Terminals
Q110	Multifunctional output
Q109	Multifunctional output
F3	Phase Q109 / Q110
F7	Phase Q108
Q108	Multifunctional output
Q107	Multifunctional output
F6	Phase Q107
Q106	Multifunctional output
Q105	Multifunctional output
F2	Phase Q105 / Q106

Terminal	Terminals
Q104	Multifunctional output
Q103	Multifunctional output
F1	Phase Q103 / Q104
E1	AC 230 V input
Q102	Multifunctional output
F5	Phase Q102
Q101	Multifunctional output
F4	Phase Q101
L	Live conductor AC 230 V
N	Neutral conductor

### Electrical connections



## Selection

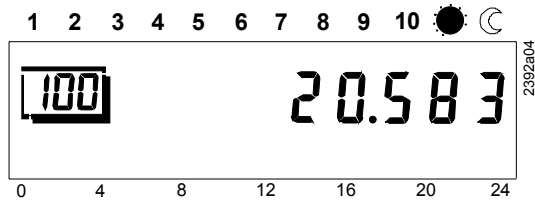
### Selecting the plant type:

Select the required type of plant (basic diagram number) on **operating line 100** (refer to page 8). The selection activates all functions that are required for the specific plant and shows the operating lines needed.

In addition, operating parameters 120 through 173 will be set to their default values required for the basic plant.

During the setting procedure, the basic diagram number on the display flashes. The required number must be confirmed by **pressing the + / - buttons twice for 3 seconds**. Then, the basic diagram number will stop flashing.

Example:



### Plant type

The basic plant diagram for the required type of plant and additional setting information will be provided by your local **Siemens Building Technologies / HVAC Products sales office**.

### Designations of relays and sensors

The relay designations used in the supplied basic diagram have the following meaning:

Relays	Function (use)	Relays	Function (use)
K1	Heat pump stage 1	Y7	Maintained boiler return temperature, oil / gas OPEN
K2	Heat pump stage 2	Y8	Maintained boiler return temperature, oil / gas CLOSED
K3	Release of external wood-fired boiler	Y9	Maintained boiler return temperature, wood OPEN
K4	Oil- / gas-fired boiler, stage 1	Y10	Maintained boiler return temperature, wood CLOSED
K5	Oil- / gas-fired boiler, stage 2	Y14	Diverting valve partial storage tank charging
K6	Electric immersion heater for d.h.w.	Y 14	Inverted Y14 signal
K8	Solar collector pump or diverting valve heat exchanger 2	Y15	Diverting valve for return
K 8	Inverted K8 signal	Y 15	Inverted Y15 signal
K9	Solar bypass valve or heat exchanger pump	Q1	Boiler pump of oil- / gas-fired boiler
K 9	Inverted K9 signal	Q2	Heating circuit pump
K10	Alarm output	Q3	D.h.w. charging pump
K11	Overtemperature protection	Q 3	Inverted Q3 signal
K 11	Inverted K11 signal	Q4	D.h.w. circulating pump
K12	Solar collector pump or diverting valve heat exchanger 1	Q5	Solar collector pump 1
K13	Output K13 for free time switch program	Q9	Heat pump circulator
K14	Release of external oil- / gas-fired boiler	Q10	Pump of wood-fired boiler
K15	Release of external heat pump	Q11	Storage tank heat transfer pump
K16	Electric immersion heater for buffer storage tank	Q12	Oil / gas bypass pump
K17	Flue gas temperature sensor function	Q13	D.h.w. storage tank heat transfer pump
K18	Output for solar swimming pool heating	Q14	System pump
K 18	Inverted K18 signal	Q15	Pump H1
Y1	Heating circuit mixing valve OPEN	Q16	Solar collector pump 2
Y2	Heating circuit mixing valve CLOSED	Q17	Additional pump Q17 for heat pump stage 2
Y3	Diverting valve d.h.w.	E1	Mains input
Y4	Heat generation lock	L	Live conductor (mains connection)
Y 4	Inverted Y4 signal	N	Neutral conductor (mains connection)

## Sensor designations

The sensor designations used in the supplied basic diagram have the following meaning:

Sensor	Function (use)	Types of sensors	Sensor	Function (use)	Types of sensors
B1	Heating circuit flow sensor	LG-Ni 1000	B7	Return sensor oil / gas	LG-Ni 1000
B2	Sensor of oil- / gas-fired boiler	LG-Ni 1000	B71	Return sensor heat pump	LG-Ni 1000
B21	Heat pump flow sensor	LG-Ni 1000	B72	Return sensor wood	LG-Ni 1000
B22	Sensor of wood-fired boiler	LG-Ni 1000	B73	Return sensor heating circuit	LG-Ni 1000
B3	D.h.w. sensor 1	LG-Ni 1000	B8	Flue gas sensor	Pt 1000
B31	D.h.w. sensor 2	LG-Ni 1000	B9	Outside sensor	LG-Ni 1000 NTC 600
B32	D.h.w. sensor 3	LG-Ni 1000	B10	Common flow sensor	LG-Ni 1000
B33	D.h.w. sensor 4	LG-Ni 1000	B13	Sensor for solar swimming pool heating	LG-Ni 1000
B4	Buffer storage tank sensor 1	LG-Ni 1000	M	Ground sensors H1, U1, P1	–
B41	Buffer storage tank sensor 2	LG-Ni 1000	H1	Contact or DC 0...10 V input	–
B42	Buffer storage tank sensor 3	LG-Ni 1000	U1	DC 0...10 V output	–
B43	Buffer storage tank sensor 4	LG-Ni 1000	P1	PWM output	–
B6	Solar collector sensor 1	LG-Ni 1000 / Pt 1000	A6	PPS data	–
B61	Solar collector sensor 2	LG-Ni 1000 / Pt 1000	MD	PPS ground	–
B62	Solar collector flow sensor		DB	LPB data	
B63	Solar flow sensor for yield measurement	LG-Ni 1000	MB	LPB ground	
B64	Solar return sensor for yield measurement	LG-Ni 1000			–

## Parameter list

### Settings to be made on the «Enduser» level

Settings that meet individual enduser needs.

	Buttons	Explanation	Line
1		Press one of the operating line selection buttons. <i>This will take you directly to programming mode "Enduser".</i>	
2		Press the operating line selection buttons to select the required operating line. <i>The following parameter list contains all settings that can be made.</i>	
3		Press the + or – button to set the required value. The setting will be stored as soon as you leave the programming mode or change to another line.	
4		To leave programming mode "Enduser", press any of the operating mode buttons. → Note: <i>If no button is pressed for about 8 minutes, the controller will automatically return to the operating mode selected last.</i>	Continuous display

## Overview of the enduser parameters

Line	Function	Range	Unit	Resolution	Factory setting
<b>Setting the clock</b>					
1	Time of day	00:00...23:59	h / min	.... : ....	–
2	Weekday	1...7	Day	..... day	–
3	Date	01.01...31.12	Day / month	.... : ....	–
4	Year	2001...2094	Year	..... year	–
<b>Time switch program for the heating circuit</b>					
5	Weekday – preselection heating circuit 1-7 7-day block 1...7 Individual days	1-7 / 1...7	Day	..... day	–
6	Switch-on time 1 <sup>st</sup> period heating circuit	00:00...24:00	h / min	.... : .... h / min	06:00
7	Switch-off time 1 <sup>st</sup> period heating circuit	00:00...24:00	h / min	.... : .... h / min	22:00
8	Switch-on time 2 <sup>nd</sup> period heating circuit	00:00...24:00	h / min	.... : .... h / min	--:--
9	Switch-off time 2 <sup>nd</sup> period heating circuit	00:00...24:00	h / min	.... : .... h / min	--:--
10	Switch-on time 3 <sup>rd</sup> period heating circuit	00:00...24:00	h / min	.... : .... h / min	--:--
11	Switch-off time 3 <sup>rd</sup> period heating circuit	00:00...24:00	h / min	.... : .... h / min	--:--
<b>Free time switch program</b>					
12	Weekday – preselection free time switch program 1-7 7-day lock 1...7 Individual days	1-7 / 1...7	Day	..... day	–
13	Switch-on time 1 <sup>st</sup> period free time switch pr.	00:00...24:00	h / min	.... : .... h / min	06:00
14	Switch-off time 1 <sup>st</sup> period free time switch pr.	00:00...24:00	h / min	.... : .... h / min	22:00
15	Switch-on time 2 <sup>nd</sup> period free time switch pr.	00:00...24:00	h / min	.... : .... h / min	--:--
16	Switch-off time 2 <sup>nd</sup> period free time switch pr.	00:00...24:00	h / min	.... : .... h / min	--:--
17	Switch-on time 3 <sup>rd</sup> period free time switch pr.	00:00...24:00	h / min	.... : .... h / min	--:--
18	Switch-off time 3 <sup>rd</sup> period free time switch pr.	00:00...24:00	h / min	.... : .... h / min	--:--
<b>Time switch program for d.h.w. heating</b>					
19	Weekday – preselection d.h.w. 1-7 7-day block 1...7 Individual days	1-7 / 1...7	Day	..... day	–
20	Switch-on time 1 <sup>st</sup> period d.h.w.	00:00...24:00	h / min	.... : .... h / min	06:00
21	Switch-off time 1 <sup>st</sup> period d.h.w.	00:00...24:00	h / min	.... : .... h / min	22:00
22	Switch-on time 2 <sup>nd</sup> period d.h.w.	00:00...24:00	h / min	.... : .... h / min	--:--
23	Switch-off time 2 <sup>nd</sup> period d.h.w.	00:00...24:00	h / min	.... : .... h / min	--:--
24	Switch-on time 3 <sup>rd</sup> period d.h.w.	00:00...24:00	h / min	.... : .... h / min	--:--
25	Switch-off time 3 <sup>rd</sup> period d.h.w.	00:00...24:00	h / min	.... : .... h / min	--:--

Line	Function	Range	Unit	Resolution	Factory setting
<b>D.h.w. values</b>					
26	Nominal setpoint of the d.h.w. temperature (TBWw) TBWR Line 770 TBWmax Line 750 <sub>EXP</sub>	TBWR...TBWmax	°C	..... °C	55
<b>Heating circuit values</b>					
27	Reduced setpoint of the room temperature (TRRw) TRF Line 28 TRN Setpoint knob	TRF...TRN	°C	..... °C	16
28	Frost protection setpoint of the room temperature (TRFw) TRR Line 27	4...TRR	°C	..... °C	10
29	Summer / winter changeover temperature	8...30	°C	..... °C	17
30	Slope of the heating curve	1.0...40	–	.....	15
33	Actual value of the room temperature (TRx)	0...50	°C	–	–
<b>General</b>					
34	Actual value of the outside temperature (TAx) To set the attenuated outside temperature to Tax, press the + / - buttons simultaneously for 3 s	-50...+50	°C	–	–
38	Resetting the enduser parameters To reset the parameters of the enduser level to their standard values, press the + / - buttons simultaneously for 3 s	0 / 1	–	–	0
39	Resetting the heating circuit and d.h.w. time switch programs To reset the time switch programs of the enduser level to their standard values, press the + / - buttons simultaneously for 3 s	0 / 1	–	–	0
<b>Holiday program</b>					
40	Preselection of the holiday period	1...8	–	.....	1
41	Beginning of the holiday period --- Inactive To deactivate the set holiday period, press the + / - buttons simultaneously for 3 s	-- / 01.01...31.12	Day / month	.... . day / month	--
42	End of the holiday period --- Inactive To deactivate the set holiday period, press the + / - buttons simultaneously for 3 s	-- / 01.01...31.12	Day / month	.... . day / month	--
<b>General / service</b>					
50	Indication of error signals No display = no fault 10 = fault outside sensor 20 = fault boiler sensor oil / gas B2 25 = fault boiler sensor wood B22 26 = fault common flow sensor B10 28 = fault flue gas sensor B8 30 = fault flow sensor heating circuit B1 33 = fault flow sensor heat pump B21 40 = fault return sensor oil / gas B7 43 = fault return sensor wood B72 44 = fault return sensor heat pump B71 47 = fault common return sensor B73 50 = fault storage tank sensor / thermostat B3 52 = fault storage tank sensor / thermostat B31 55 = fault storage tank sensor / thermostat B32 56 = fault storage tank sensor / thermostat B33 61 = fault room unit 70 = fault storage tank sensor B4 71 = fault storage tank sensor B41 72 = fault storage tank sensor B42 73 = fault collector sensor B6 74 = fault collector sensor B61 75 = fault solar flow sensor B62 76 = fault storage tank sensor B43 79 = fault water / brine sensor B11 81 = short-circuit data bus (LPB) 82 = same bus address exists several times 86 = short-circuit PPS 100 = 2 clock time masters on the data bus (LPB) 127 = legionella temperature not reached 130 = maximum flue gas temperature exceeded				

Line	Function	Range	Unit	Resolution	Factory setting
	134 = fault heat pump at input H1 135 = water / brine temperature too low 137 = fault heat pump at input E1 138 = fault control sensor heat pump (operating line 420) 145 = wrong PPS unit (BMU / room unit) 146 = configuration error (operating line 202) 147 = external heat source missing (PPS / LPB) 150 = fault BMU 171 = alarm signal at input H1 172 = alarm signal at input E1 211 = fault wood-fired boiler 231-239 = fault sensor input B101 - B109 241 = fault flow sensor yield measurement B63 242 = fault return sensor measurement B64 243 = fault swimming pool sensor B13				
<b>Oil- or gas-fired boiler</b>					
60	Chimney sweep 0 = OFF 1 = ON Outside the programming level, the + / - buttons can be used to activate / deactivate the second burner stage	0 / 1	–	–	0
<b>Solar collectors</b>					
65	24-hour yield solar energy	0...999.9	kWh	–	0
66	Total yield solar energy To reset the total yield to 0, press the + / - buttons simultaneously for 3 s	0...9999999.9	kWh	–	0
<b>Heat pump</b>					
75	Acknowledgement of heat pump error messages 135 and 137 To reset the error messages to 0, press the + / - buttons simultaneously for 3 s	0 / 1	–	–	0

### Settings to be made on the «Heating engineer» level

Settings required for the configuration and parameterization by the heating engineer.

	Buttons	Explanation	Line
1		Press both operating line selection buttons for at least 3 seconds.  This will take you to programming level "Enduser".	
2		Press the operating line selection buttons to select the required operating line. <i>The parameter list on the next pages contains all operating lines on which settings can be made.</i>	
3		Press the + or – button to set the required value. The setting will be stored as soon as you leave the programming mode or change to another operating line.	
4		To leave programming level "Heating engineer", press one of the operating mode buttons. <b>→ Note:</b> <i>If no button is pressed for about 8 minutes, the controller will automatically return to the operating mode selected last.</i>	Continuous display



## Overview of the heating engineer parameters

Line	Function	Range	Unit	Resolution	Factory setting
<b>General / service</b>					
<i>Basic diagrams</i>					
100	Selection of the basic diagram 0 No basic diagram selected 1...99.998 Basic diagrams To adopt the selected diagram number, press the + / - buttons simultaneously for 3 s	0...99.998	–	.....	0
<b>Configuration</b>					
<i>Partial diagrams</i>					
120	Selection of partial diagram oil- / gas-fired boiler 0 Partial diagram inactive (OeG0) 1...9 Partial diagrams OeG1 through OeG9	0...9	–	.....	0
121	Selection of partial diagram solar collectors 0 Partial diagram inactive (OeG0) 1...16 Partial diagrams Sol1 through Sol16	0...16	–	.....	0
122	Selection of partial diagram wood-fired boiler 0 Partial diagram inactive (Ho0) 1...5 Partial diagrams Ho1 through Ho5	0...5	–	.....	0
123	Selection of partial diagram heat pump 0 Partial diagram inactive (Wp0) 1...5 Partial diagrams Wp1 through Wp5	0...5	–	.....	0
124	Display of partial diagram buffer storage tank 0 Partial diagram inactive (Sp0) 1...3 Partial diagrams Sp1 through Sp3	0...3	–	.....	0
125	Display of partial diagram d.h.w. storage tank 0 Partial diagram inactive (BwSp0) 1...10 Partial diagrams BwSp1 through BwSp10	0...10	–	.....	0
126	Selection of partial diagram combi storage tank 0 Partial diagram inactive (KoSp0) 1...6 Partial diagrams KoSp1 through KoSp6	0...6	–	.....	0
127	Selection of partial diagram heating circuit 0 Partial diagram inactive (Rh0) 1...3 Partial diagrams Rh1 through Rh3	0...3	–	.....	0
<i>Hiding sensors that are not required</i>					
130	Source outside sensor 0 Signal via bus (PPS or LPB) 1 Signal via terminal	0 / 1	–	.....	0
131	Reduction 1 <sup>st</sup> d.h.w. sensor B3 0 Without sensor B3 1 With sensor B3	0 / 1	–	.....	0
132	Reduction 2 <sup>nd</sup> d.h.w. sensor B31 0 Without sensor B31 1 With sensor B31	0 / 1	–	.....	0
133	Reduction 2 <sup>nd</sup> buffer storage tank sensor B41 0 Without sensor B41 1 With sensor B41	0 / 1	–	.....	0
135	Reduction wood-fired boiler return sensor B72 0 Without sensor B72 1 With sensor B72	0 / 1	–	.....	0
136	Reduction heat pump flow sensor B21 0 Without sensor B21 1 With sensor B21	0 / 1	–	.....	0
137	Reduction heat pump return sensor B71 0 Without sensor B71 1 With sensor B71	0 / 1	–	.....	0
138	Reduction water / brine sensor B11 0 Without sensor B11 1 With sensor B11	0 / 1	–	.....	0

Line	Function	Range	Unit	Resolution	Factory setting
	<i>Auxiliary functions</i>				
140	Return diversion Y15 (ZuFu1) --- None 101..110 Relay Y15 at relay terminal Q101...110	101...110	—	.....	---
141	Return diversion valve inverted Y <sup>-</sup> 15 (ZuFu1) --- None 101..110 Relay Y15 at relay terminal Q101...110	101...110	—	.....	---
142	Return diversion sensor B73 (ZuFu1) --- None 101..109 Sensor at sensor terminal B101...B109	101...109	—	.....	---
143	Partial storage tank charging Y14 (ZuFu2) --- None 101..110 Relay Y14 at relay terminal Q101...110	101...110	—	.....	---
144	Partial storage tank charging valve inverted Y <sup>-</sup> 14 (ZuFu2) --- None 101..110 Relay Y 14 at relay terminal Q101...110	101...110	—	.....	---
145	Partial storage tank charging sensor B43 (ZuFu2) --- None 101..109 Sensor B43 at sensor terminal B101...109	101...109	—	.....	---
146	Storage tank heat transfer pump Q11 (ZuFu3) --- None 101..110 Relay Q11 at relay terminal Q101...110	101...110	—	.....	---
147	D.h.w. circulating pump Q4 (ZuFu4) --- None 101..110 Relay Q4 at relay terminal Q101...110	101...110	—	.....	---
148	Additional pompe Q17 for heat pump stage 2 (ZuFu5) --- None 101..110 Relay Q17 at relay terminal Q101...110	101...110	—	.....	---
149	System pump Q14 (ZuFu6) --- None 101..110 Relay Q14 at relay terminal Q101...110	101...110	—	.....	---
150	Pump H1 Q15 (ZuFu7) --- None 101..110 Relay Q15 at relay terminal Q101...110	101...110	—	.....	---
151	Alarm output K10 (ZuFu8) --- None 101..110 Relay K10 at relay terminal Q101...110	101...110	—	.....	---
152	Output overtemperature protection K11 (ZuFu9) --- None 101..110 Relay K11 at relay terminal Q101...110	101...110	—	.....	---
153	Output overtemperature protection inverted K <sup>-</sup> 11 (ZuFu9) --- None 101..110 Relay K 11 at relay terminal Q101...110	101...110	—	.....	---
154	Relay for flue gas temperature function K17 (ZuFu10) --- None 101..110 Relay K17 at relay terminal Q101...110	101...110	—	.....	---
155	Flue gas sensor B8 (ZuFu10) --- None 101..109 Sensor B8 at sensor terminal B101...109	101...109	—	.....	---
156	3 <sup>rd</sup> buffer storage tank sensor B42 (ZuFu11) --- None 101..109 Sensor B42 at sensor terminal B101...109	101...109	—	.....	---
157	Common flow sensor B10 (ZuFu12) --- None 101..109 Sensor B10 at sensor terminal B101...109	101...109	—	.....	---
158	Solar flow sensor B62 (ZuFu13) --- None 101..109 Sensor B62 at sensor terminal B101...109	101...109	—	.....	---
159	Solar flow sensor B63 for yield measurement (ZuFu14) --- None 101..109 Sensor B63 at sensor terminal B101...109	101...109	—	.....	---

<i>Line</i>	<i>Function</i>	<i>Range</i>	<i>Unit</i>	<i>Resolution</i>	<i>Factory setting</i>
160	Solar return sensor B64 for yield measurement (ZuFu14) --- None 101..109 Sensor B64 at sensor terminal B101...109	101...109	—	.....	---
161	Solar heat exchanger diverting valve inverted K <sup>-</sup> 8 (ZuFu15) --- None 101..110 Relay K <sup>-</sup> 8 at relay terminal Q101...110	101...110	—	.....	---
162	Solar diverting valve inverted K <sup>-</sup> 9 (ZuFu16) --- None 101..110 Relay K <sup>-</sup> 9 at relay terminal Q101...110	101...110	—	.....	---
169	Output K13 for free time switch program (ZuFu23) --- None 101..110 Relay K13 to relay terminal Q101...110	101...110	—	.....	---
170	Electric immersion heater buffer storage tank K16 (ZuFu24) --- None 101..110 Relay K16 at relay terminal Q101...110	101...110	—	.....	---
171	Electric immersion heater d.h.w. storage tank K6 (ZuFu25) --- None 101..110 Relay K6 at relay terminal Q101...110	101...110	—	.....	---
172	D.h.w. diverting valve inverted Q <sup>-</sup> 3 (ZuFu26) --- None 101..110 Valve / pump Q <sup>-</sup> 3 at relay terminal Q101...110	101...110	—	.....	---
173	Heat generation lock Y4 (ZuFu27) --- None 101..110 Relay Y4 to relay terminal Q101...110	101...110	—	.....	---
174	Heat generation lock inverted Y <sup>-</sup> 4 (ZuFu27) --- None 101..110 Relay Y <sup>-</sup> 4 at relay terminal Q101...110	101...110	—	.....	---
175	Solar swimming pool heating K18 (ZuFu28) --- None 101..110 Relay K18 at relay terminal Q101...110	101...110	—	.....	---
176	Solar swimming pool heating inverted K <sup>-</sup> 18 (ZuFu28) --- None 101..110 Relay K <sup>-</sup> 18 at relay terminal Q101...110	101...110	—	.....	---
177	Solar swimming pool heating sensor B13 (ZuFu28) --- None 101..109 Sensor B13 at sensor terminal B101...109	101...109	—	.....	---
<b>Miscellaneous</b>					
193	D.h.w. heating with charging pump or diverting valve (Q3) 0 Charging pump 1 Diverting valve	0 / 1	—	.....	---
194	Setpoint and time switch program for d.h.w. heating with BMU 0 No 1 Yes	0 / 1	—	.....	0
195	Function of system pump Q14 1 For heating circuit only 2 For heating circuit and d.h.w. 3 With external heat demand	1...3	—	.....	1
<b>General</b>					
<b>Diagnosis configuration</b>					
200	Display of relay terminal assignment Query with the + / - buttons	101...110	—	—	—
201	Display of sensor terminal assignment Query with the + / - buttons	101...109	—	—	—

<i>Line</i>	<i>Function</i>	<i>Range</i>	<i>Unit</i>	<i>Resolution</i>	<i>Factory setting</i>
202	Display of configuration errors No display = no error 1-10 = terminals Q101 - Q110 used beyond capacity 11-19 = terminals B101 - B109 used beyond capacity 24 = B73, Y15 or Y <sup>-</sup> 15 missing 26 = B43, Y14 or Y <sup>-</sup> 14 missing 33 = B62 incompatible with partial diagram "Solar" 34 = d.h.w. heating BMU incompatible with partial diagram "D.h.w. / combi storage tank" 38 = external heat source incompatible with partial diagram "Oil / gas" 39 = inadmissible reduction B72 40 = B13 or K18 / K <sup>-</sup> 18 missing 41 = B8 missing for function with K17 42 = Q17 incompatible with partial diagram "Heat pump" 43 = Q <sup>-</sup> 3 incompatible with partial diagram "D.h.w. / combi storage tank" 45 = K <sup>-</sup> 9 incompatible with partial diagram "Solar" 51 = inadmissible reduction of B21 and B71 54 = d.h.w. heating BMU incompatible with partial diagram "Oil / gas" 55 = inadmissible reduction of B3 without d.h.w. heating BMU	1...99	—	—	—
203	Display of plant diagram identification number part 1	0...99'999'999	—	—	—
204	Display of plant diagram identification number part 2	0...99'999'999	—	—	—
205	Display of plant diagram identification number part 3	0...99'999'999	—	—	—
206	Display of plant diagram identification number part 4	0...99'999'999	—	—	—
<b>Terminal test</b>					
210	Output test (relay test) --- Control mode according to the operating state 0 All outputs deactivated 1 Q101 ON 2 Q102 ON 3 Q103 ON 4 Q104 ON 5 Q105 ON 6 Q106 ON 7 Q107 ON 8 Q108 ON 9 Q109 ON 10 Q110 ON	0...10	—	—	—
211	Input test (sensor test) 1 Sensor at B101 2 Sensor at B102 3 Sensor at B103 4 Sensor at B104 5 Sensor at B105 6 Sensor at B106 7 Sensor at B107 8 Sensor at B108 9 Sensor at B109 10 Room sensor (PPS room unit) 11 Input H1 (ontact or DC 0...10 V) 12 Input E1 (AC 230 V)	1...12	—	—	—
212	Display of PPS communication Query with the + / - buttons - - - No communication 1...12 PPS device address 0...255 Identification code	--- / 1..12 / 0..255	—	—	—
<b>Setpoint / actual value of common flow</b>					
220	Display of the common flow temperature setpoint --- No value available	0.0...140.0	°C	—	—
221	Actual value of the common flow temperature --- No value available	0...140	°C	—	—
<b>Flue gas temperature</b>					
222	Actual value of the flue gas temperature B8 --- No value available	-50...350	°C	—	—
223	Maximum value of the flue gas temperature display B8 --- No value available To reset the maximum value to the actual value, press the + / - buttons simultaneously for 3 s	-50...350	°C	—	0

Line	Function	Range	Unit	Resolution	Factory setting
224	Maximum limitation of the flue gas temperature --- Function deactivated	--- / 0...350	°C	..... °C	---
225	Switch-on temperature flue gas sensor function (ZuFu10)	0...350	°C	..... °C	60
226	Switch-off temperature flue gas sensor function (ZuFu10)	0...350	°C	..... °C	40
<b>Oil- / gas-fired boiler</b>					
<i>Setpoints / actual values</i>					
250	Display of the boiler temperature setpoint (TKw) (internal or external PPS-BMU) --- No values available	0...140	°C	–	–
251	Actual value of the boiler temperature (TKx) B2 or external PPS-BMU --- No values available	–50...350	°C	–	–
252	Setpoint minimum limitation of the return temperature	Line 280 <sub>EXP</sub> ...95	°C	.....	8
253	Actual value of the return temperature B7 --- No value present	–50...350	°C	–	–
<i>Burner hours run counter / start counter</i>					
256	Burner operating hours stage 1 or PPS-BMU Output K4 or PPS To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	–	0
257	Burner operating hours stage 2 Output K5 To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	–	0
258	Number of burner starts stage 1 Output K4 To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	–	–	0
259	Number of burner starts stage 2 Output K5 To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	–	–	0
<i>Functions</i>					
270	Minimum limitation of the boiler temperature (TKmin)	250 <sub>EXP</sub> ... 251 <sub>EXP</sub> (max. 95°C)	°C	.....°C	40
271	Frost protection for the plant with the boiler pump 0 General frost protection for the plant does not act on this pump 1 General frost protection for the plant acts on this pump	0 / 1	–	.....	1
<i>Diagnosis</i>					
295	Display of BMU error code	0...255	–	–	–
296	Function test oil- / gas-fired boiler --- No test 0 Everything OFF 1 Boiler pump ON (Q1) 2 In addition, burner stage 1 ON (Q1+K4) 3 In addition, burner stage 2 ON (Q1+K4+K5) 4 Maintained boiler return temperature fixed ON (Q1+K4+K5+Q12/Y7) 5 Maintained boiler return temperature fixed OFF (Q1+K4+K5+Q12+Y8)	--- / 0...5	–	–	---
<b>Solar collectors</b>					
<i>Setpoints / actual values</i>					
300	Actual value of collector temperature B6 --- No value available	–50...350	°C	–	–
301	Actual value of collector temperature B61 --- No value available	–50...350	°C	–	–
302	Actual value of collector flow temperature B62 --- No value available	–50...350	°C	–	–
303	Maximum value of collector temperature 1 (B6) To make a reset to the actual value, press the + / - buttons simultaneously for 3 s	–50...350	°C	–	0
304	Maximum value of collector temperature 2 (B61) To make a reset to the actual value, press the + / - buttons simultaneously for 3 s	–50...350	°C	–	0

Line	Function	Range	Unit	Resolution	Factory setting
<b>Temperature differential collector / heat exchanger</b>					
305	Display of the temperature differential collector 1 / heat exchanger 1 --- No value available	-50...350	K	-	-
306	Display of the temperature differential collector 1 / heat exchanger 2 --- No value available	-50...350	K	-	-
307	Display of temperature differential collector 2 / heat exchanger 1 --- No value available	-50...350	K	-	-
308	Display of temperature differential collector 2 / heat exchanger 2 --- No value available	-50...350	K	-	-
309	Temperature differential collector 1 / swimming pool --- No value available	-50...350	K	-	1
310	Temperature differential collector 2 / swimming pool --- No value available	-50...350	K	-	1
<b>Hours run counter</b>					
311	Operating hours collector pump 1 (output Q5) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	-	0
312	Operating hours collector pump 2 (output Q16) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	-	0
313	Operating hours pump K12 To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	-	0
314	Operating hours diverting valve K8 To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	-	0
315	Operating hours swimming pool heating K188 To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	-	0
<b>Swimming pool heating</b>					
317	Setpoint temperature swimming pool	0...line 321	°C	..... °C	25
318	Actual value of swimming pool temperature B13 --- No value available	-50...350	°C	-	-
319	Temperature differential swimming pool ON	Line 320...40	K	..... K	8
320	Temperature differential swimming pool OFF	0...line 319	K	..... K	4
321	Maximum swimming pool charging temperature	20...95	°C	..... °C	35
322	Heat exchanger pump operation for swimming pool 1 Alternatively 2 Parallel	1 / 2	-	.....	1
323	Measured value correction swimming pool sensor B13	-10.0...10.0	K	..... K	0.0
<b>Functions</b>					
324	Selection of collector sensor B6 / B61 1 LG-Ni 1000 2 Pt 1000	1...2	-	.....	1
325	Measured value correction of collector sensor 1 B6	-10.0...10.0	K	..... K	0.0
326	Measured value correction of collector sensor 2 B61	-10.0...10.0	K	..... K	0.0
327	Measured value correction of collector flow sensor B62	-10.0...10.0	K	..... K	0.0
328	Heat exchanger pump operation partial diagram Sol5 1 Alternative operation 2 Parallel operation	1...2	-	.....	2
329	Temperature differential ON heat exchanger 1	Line 330...40	°C	..... °C	8
330	Temperature differential OFF heat exchanger 1	0...line 329	°C	..... °C	4
331	Temperature differential ON heat exchanger 2	Line 332...40	°C	..... °C	8
332	Temperature differential OFF heat exchanger 2	0...line 331	°C	..... °C	4
333	Priority with 2 heat exchangers 1 No priority 2 Relative priority buffer storage tank (heat exchanger 1) 3 Absolute priority buffer storage tank (heat exchanger 1) 4 Relative priority d.h.w. storage tank (heat exchanger 2) 5 Absolute priority d.h.w. storage tank (heat exchanger 2)	1...5	-	.....	4
<b>Solar yield / recooling measurement</b>					
338	Type of antifreeze agent used 1 None (only water) 2 Ethylenglycol 3 Propylenglycol 4 Mixture of Ethylen- and Propylenglycol	1...4	-	.....	1

<i>Line</i>	<i>Function</i>	<i>Range</i>	<i>Unit</i>	<i>Resolution</i>	<i>Factory setting</i>
339	Concentration of antifreeze agent	1...100	%	..... %	30
340	Pulse value flow meter (supports 1, 2.5, 10, 25, 100 liters / pulse)	1.0 / 2.5 / 10 / 25 / 100	–	.....	10.0
341	Volumetric flow solar pump	10...1500	Liters/h	..... Liters/h	200
342	Selection of sensor for solar yield measurement (B63 and B64) 1 LG-Ni 1000 2 Pt 1000	1 / 2	–	.....	2
343	Actual value of solar flow temperature B63 --- No value available	–50...350	°C	–	–
344	Actual value of solar return temperature B64 --- No value available	–50...350	°C	–	–
<b>Speed-controlled pump</b>					
345	Display of speed of solar pump Q5 / K9	0...100	%	–	–
346	Minimum speed of the solar pump	0...line 347	%	..... %	40
347	Maximum speed of the solar pump	Line 346 ...100	%	..... %	100
<b>Diagnosis</b>					
349	Functional test solar --- No test 0 Everything OFF 1 Q5 ON 2 Q5/K12 + Q16 ON 3 Q5/K12 + Q16 + K9 ON 4 Q5/K12 + Q16 + K9 + K8 ON	--- / 0...4	–	–	---
<b>Wood-fired boiler</b>					
<b>Setpoints / actual values</b>					
350	Display of the boiler temperature setpoint	0...140	°C	–	–
351	Display of actual value of boiler temperature B22 --- No value available	–50...350	°C	–	–
352	Display of the boiler return temperature setpoint	0...140	°C	–	–
353	Display of actual value of return temperature B72 --- No value available	–50...350	°C	–	–
<b>Hours run counter</b>					
354	Operating hours pump of wood-fired boiler (output Q10) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	–	0
355	Operating hours wood-fired boiler (output K3) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	–	0
356	Number of releases of wood-fired boiler (output K3) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	–	–	0
<b>Functions</b>					
369	Minimum temperature differential of the wood-fired boiler	0...20	K	..... K	4
370	Minimum temperature of the wood-fired boiler for re- lease of the pump	20...80	°C	..... °C	60
371	Switching differential for minimum temperature of the wood-fired boiler for release of the pump	1...30	K	..... K	12
372	Pump overrun time --- No pump overrun time	--- / 4...120	min	..... min	20
373	Strategy of wood-fired boiler 0 Constant 1 Depending on demand	0 / 1	–	.....	1
376	Wood-fired boiler locks all other heat sources 0 No 1 Yes	0 / 1	–	.....	1
378	Frost protection for the plant with pump of the wood- fired boiler 0 General frost protection for the plant does not act on this pump 1 General frost protection for the plant acts on this pump	0 / 1	–	.....	1

Line	Function	Range	Unit	Resolution	Factory setting
<b>Residual heat function</b>					
385	Maximum duration of the residual heat function --- Function deactivated	--- / 5...60	min	..... min	---
386	Perform residual heat function once / several times 0 Once 1 Several times	0 / 1	–	.....	0
387	Residual heat function with buffer stratification protection 0 No 1 Yes	0 / 1	–	.....	0
388	Residual heat function directly for the consumers 0 No 1 Yes	0 / 1	–	.....	0
<b>Speed-controlled pump</b>					
390	Display of speed of pump Q10 of the wood-fired boiler	0...100	%	–	–
391	Minimum speed of pump of the wood-fired boiler	0...line 392	%	..... %	50
392	Maximum speed of pump of the wood-fired boiler	Line 91...100	%	..... %	100
<b>Diagnosis</b>					
395	Functional test of the wood-fired boiler --- No test 0 Everything OFF 1 Boiler pump ON (Q10) 2 In addition, burner ON (Q10 + K3) 3 In addition, maintained boiler return temperature ON (Q10 + K3 + Y10) 4 In addition, maintained boiler return temperature OFF (Q10 + K3 + Y9)	--- / 0...4	–	–	---
<b>Heat pump</b>					
<b>Setpoints / actual values</b>					
400	Display of setpoint of the heat pump flow temperature	0...140	°C	–	–
401	Actual value of heat pump flow temperature B21 --- No value available	–50...350	°C	–	–
402	Display of setpoint of the heat pump return temperature	0...140	°C	–	–
403	Actual value of heat pump return temperature B71 --- No value available	–50...350	°C	–	–
404	Actual value of water / brine flow temperature B11 --- No value available	–50...350	°C	–	–
<b>Hours run counter</b>					
410	Operating hours stage 1 (output K1) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	–	0
411	Operating hours stage 2 (output K2) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	–	0
412	Number of starts of stage 1 (output K1) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	–	–	0
413	Number of starts of stage 2 (output K2) To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	–	–	0
<b>Functions</b>					
420	Control sensor for the heat pump: 1 Flow sensor (B21) 2 Return sensor (B71) 3 Common flow sensor (B10) 4 Mean value ((B21+B71)/2) 5 ON with flow sensor (B21) / OFF with return sensor (B71) 6 ON with flow sensor (B21) / OFF with buffer sensor (B42 / B41 / B4) 7 ON with common flow sensor (B10) / OFF with buffer sensor (B42 / B41 / B4) 8 ON with return sensor (B71) / OFF with buffer sensor (B42 / B41 / B4) 9 On with buffer sensor (B4) OFF with return sensor (B71)	1...9	–	.....	2
421	Heat pump switching differential ON (SDWp)	1...20	K	..... K	2
422	Heat pump switching differential OFF (SDWp)	1...20	K	..... K	2
423	Flow / return temperature differential at –10 °C	1...30	K	..... K	8
424	Compensation of mixing valve boost --- Function deactivated	--- / 0...50	K	..... K	---
426	Frost protection for the heat pump circulator 0 Frost protection does not act on this circulator 1 Frost protection acts on this circulator	0 / 1	–	.....	1



Line	Function	Range	Unit	Resolution	Factory setting
427	Additional pump kick for water / brine pump 0 No 1 Yes	0 / 1	–	.....	0
428	Control of the heat pump circulator	0 / 1	–	.....	1
<b>Diagnosis</b>					
445	Functional test of the heat pump --- No test 0 Everything OFF 1 Q8 ON (solar pump), 2 Q8+Q9 ON (plus heat pump circulator) 3 Q8+Q9+K1 ON (plus 1 <sup>st</sup> stage), 4 Q8+Q9+K1+K2 ON (plus 2 <sup>nd</sup> stage)	--- / 0...4	–	–	---
<b>Buffer storage tank</b>					
<b>Setpoints / actual values</b>					
450	Actual value of buffer storage tank temperature B4 at the top --- No value available	–50...350	°C	–	–
451	Actual value of buffer storage tank temperature B41 at the bottom --- No value available	–50...350	°C	–	–
452	Actual mean value of buffer storage tank temperature B42 --- No value available	–50...350	°C	–	–
453	Actual value of buffer storage tank temperature B43 for partial charging --- No value available	–50...350	°C	–	–
454	Maximum value of buffer storage tank temperature B4 To make a reset to the actual value, press the + / - buttons simultaneously for 3 s	–50...350	°C	–	0
455	Display of actual value of return temperature B73 --- No value available	–50...350	°C	–	–
456	Display of setpoint of the buffer storage tank temperature To adjust the setpoint of the buffer storage tank temperature to the current heat demand, press the + / - buttons simultaneously for 3 s	0...140	°C	–	0
<b>Functions</b>					
470	Recharge control buffer storage tank with the wood-fired boiler 0 With sensor B4 (switching differential) 1 With sensors B4 / B41 (start / stop)	0 / 1	–	.....	0
471	Minimum buffer storage tank level when charging with the collector (TPmin)	0...line 472	°C	..... °C	0
472	Maximum buffer storage tank charging temperature	Line 471... line 450 <sub>EXP</sub>	°C	..... °C	80
473	Automatic heat generation lock --- OFF 0 With B4 1 With B4 and B41 / B42	--- / 0...1	–	.....	0
474	ΔT between buffer storage tank and heat demand of the heating circuit (for automatic heat generation lock)	–20...20	K	..... K	-2
475	Forced charging of buffer storage tank with heat pump 0 None 1 Slave pointer / B4, 2 Slave pointer / B41 or B42, 3 Max. buffer storage tank charging temperature / B4, 4 Max. buffer storage tank charging temperature / B41 or B42	0...4	–	.....	0
<b>Return diversion (ZuFu 1)</b>					
480	Return diversion temperature differential ON	Line 481...40	K	..... K	10
481	Return diversion temperature differential OFF	0...Zeile 480	K	..... K	5
482	Operating action of return diversion 1 As return temperature setback 2 As return temperature boost	1...2	–	.....	1
483	Storage tank sensor for return diversion 1 Sensor B4 2 Sensor B41 3 Sensor B42	1...3	–	.....	2

Line	Function	Range	Unit	Resolution	Factory setting
	<i>Electric immersion heater</i>				
484	Release outside temperature for electric immersion heater buffer storage tank --- Function deactivated	--- / -30...30	°C	..... °C	-5
485	Selection of control sensor for electric immersion heater of the buffer storage tank 0 Common flow sensor B10 1 Buffer storage tank sensor B4	0 / 1	-	.....	1
	<i>Overtemperature protection</i>				
489	Differential of maximum storage tank temperature (MSP) and buffer storage tank safety temperature	1...50	K	..... K	5
490	Hysteresis for buffer storage tank cooling function with priority 1	1...20	°C	..... °C	5
491	Priority buffer storage tank cooling with heat transfer pump --- Function deactivated 1 Priority 1 2 Priority 2	--- / 1...2	-	.....	---
492	Priority buffer storage tank cooling with collector pump --- Function deactivated 1 Priority 1 2 Priority 2	--- / 1...2	-	.....	---
493	Priority buffer storage tank cooling with heat source pump --- Function deactivated 1 Priority 1 2 Priority 2	--- / 1...2	-	.....	---
494	Priority buffer storage tank cooling with overtemperature protection output --- Function deactivated 1 Priority 1 2 Priority 2	--- / 1...2	-	.....	---
495	Priority buffer storage tank cooling by delivering heat for space heating --- Function deactivated 1 Priority 1 2 Priority 2	--- / 1...2	-	.....	---
<b>Storage tank temperature</b>					
	<i>Functions</i>				
520	D.h.w. heating with electric immersion heater K6 1 Frost protection for the storage tank 2 Only in summer operation 3 Always	1...3	-	.....	2
521	Recharge control d.h.w. storage tank 0 With sensor B3 (switching differential) 1 With sensors B3 and B31 (start / stop) 2 D.h.w. heating like setting 0, legionella function like setting 1	0...2	-	.....	0
522	Minimum d.h.w. storage tank level when charging with collector (TBmin)	0...line 523	°C	..... °C	0
523	Maximum d.h.w. storage tank charging temperature	Line 522... line 500 <sub>EXP</sub>	°C	..... °C	80
	<i>Heat transfer d.h.w. storage tank</i>				
530	Heat transfer with d.h.w. sensor 0 With sensor B3 1 With sensor B31	0 / 1	-	.....	0
531	Automatic heat transfer from the buffer to the d.h.w. storage tank --- Function deactivated 1 With Q3 2 With Q11	--- / 1...2	-	.....	1
532	Heat transfer strategy in the summer 0 Only for frost protection 1 According to d.h.w. release 2 Always	0...2	-	.....	2
533	Heat transfer strategy in the winter 0 Only for frost protection 1 According to d.h.w. release 2 Always	0...2	-	.....	2

Line	Function	Range	Unit	Resolution	Factory setting
534	Temperature differential ON heat transfer	Line 535...40	°C	..... °C	6
535	Temperature differential OFF heat transfer	0...line 534	°C	..... °C	4
<b>Overtemperature protection d.h.w. storage tank</b>					
539	Differential of maximum storage tank temperature (MSB) and d.h.w. storage tank safety temperature	1...50	K	..... K	5
540	Hysteresis of the d.h.w. cooling function with priority 1	1...20	°C	..... °C	5
541	Priority of d.h.w. storage tank cooling with transfer pump --- Function deactivated 1 Priority 1 2 Priority 2	--- / 1...2	–	.....	---
542	Priority of d.h.w. storage tank cooling with collector pump --- Function deactivated 1 Priority 1 2 Priority 2	--- / 1...2	–	.....	---
544	Priority of d.h.w. storage tank cooling with overtemperature protection output K11 --- Function deactivated 1 Priority 1 2 Priority 2	--- / 1...2	–	.....	---
<b>Diagnosis</b>					
545	Functional test of d.h.w. storage tank --- No test 0 Everything off 1 Charging pump ON (Q3) 2 In addition, diverting valve ON (Q3 + Y3) 3 Transfer pump ON (Q11)	--- / 0...3	–	.....	---
<b>Combi storage tank</b>					
570	B4 delivers temperature for functionality B31 0 No 1 Yes	0 / 1	–	.....	0
<b>Bivalent operation</b>					
<b>Heat source sequence</b>					
620	Lead heat source 1 Oil- / gas-fired boiler 2 Heat pump 3 Wood-fired boiler	1...3	–	.....	–
621	Switch-on delay lag heat source	1...255	min	..... min	10
622	Release limit for lag heat source	0...500	K*min	.....K*min	200
623	Reset limit for lag heat source	0...500	K*min	.....K*min	50
<b>Release according to the outside temperature</b>					
630	Release of oil- / gas-fired boiler below the outside temperature threshold --- Boiler always released	--- / -30...30	°C	..... °C	---
631	Release of heat pump above the outside temperature threshold --- Heat pump always released	--- / -30...30	°C	..... °C	---
632	Release of wood-fired boiler below the outside temperature threshold --- Boiler always released	--- / -30...30	°C	..... °C	---
<b>D.h.w. heating</b>					
640	Heat source strategy for d.h.w. heating 1 D.h.w. according to the current heat source sequence. 2 D.h.w. with lag heat source, lead heat source maintains the room temperature setpoint during d.h.w. heating. 3 D.h.w. with lag heat source, lead heat source is shut down during d.h.w. heating. 4 D.h.w. with lag heat source if released, lead heat source maintains the room temperature setpoint during d.h.w. heating. 5 D.h.w. with lag heat source if released, lead heat source is shut down during d.h.w. heating.	1...5	–	.....	1

Line	Function	Range	Unit	Resolution	Factory setting
<b>Heating circuit / space heating</b>					
<i>Setpoints / actual values</i>					
700	Display of the nominal room temperature setpoint Nominal setpoint plus readjustment made on the room unit	0.0...35.0	°C	–	–
701	Display of the room temperature setpoint (TRw)	0.0...35.0	°C	–	–
702	Display of heating circuit flow temperature setpoint TVw	0...140	°C	–	–
703	Display of actual value of heating circuit flow temperature TVx B1 --- No value available	--- / -50...350	°C	–	–
704	Attenuated outside temperature (TAged)	-50.0...50.0	°C	–	0
705	Composite outside temperature (TAgem)	-50.0...50.0	°C	–	–
706	Measured value correction of outside sensor B9	-10.0...10.0	K	..... K	0
<i>Functions</i>					
720	Parallel displacement of heating curve	-4.5...+4.5	K	..... K	0.0
721	Room influence 0 Inactive 1 Active	0 / 1	–	.....	1
722	Switching differential of the room temperature (SDR) - - - - Inactive 0.5...4.0 Active	- - - - / 0.5...4.0	K	..... K	- - - -
723	Min. limitation of the flow temperature setpoint (TVmin) Tvmax Line 724	8...TVmax	°C	..... °C	8
724	Max. limitation of the flow temperature setpoint (TVmax) Tvmin Line 723	TVmin...95	°C	..... °C	80
725	Type of building construction 0 Heavy 1 Light	0 / 1	–	.....	1
726	Adaption of the heating curve 0 Inactive 1 Active	0 / 1	–	.....	1
727	Maximum forward shift of optimum start control	00:00...06:00	hh:mm	.... : .... hh:mm	00:00
728	Maximum forward shift of optimum stop control	00:00...06:00	hh:mm	.... : .... hh:mm	00:00
730	Locking signal gain heating circuit	0...200	%	..... %	100
732	Frost protection for the plant with the heating circuit 0 General frost protection for the plant does not act on this pump 1 General frost protection for the plant acts on this pump	0 / 1	–	.....	1
733	Outside temperature for start of the room temperature setpoint boost	Line 734...10	°C	1	- - -
734	Outside temperature for end of the room temperature setpoint boost	-30... line 733	°C	1	-10
<i>Floor curing function</i>					
738	Floor curing dates 0 OFF 1 Functional heating 2 Floor curing heating 3 Functional and floor curing heating	0...3	–	.....	0
739	Floor curing data	0...32 / 0...95	Day / °C	–	–
<i>Speed-controlled pump</i>					
740	Display of speed heating circuit pump Q2	0...100	%	–	–
741	Minimum speed of the heating circuit pump	0...line 742	%	..... %	100
742	Maximum speed of the heating circuit pump	Line 741 ...100	%	..... %	100
743	Speed reduction heating circuit pump 0 According to the heating circuit operating level 1 According to the characteristic	0 / 1	–	.....	1

Line	Function	Range	Unit	Resolution	Factory setting
<b>Diagnosis</b>					
745	Functional test of the heating circuit --- No test 0 Everything OFF 1 Heating circuit pump ON (Q2) 2 In addition, mixing valve CLOSED (Q2 + Y2) 3 In addition, mixing valve OPEN (Q2 + Y1)	--- / 0...3	–	–	---
<b>D.h.w. values</b>					
<b>Setpoints / actual values</b>					
750	Display of the d.h.w. temperature setpoint (TBWw)	0...140	°C	–	–
751	Actual value of d.h.w. temperature sensor B3 / BMU --- No value available	--- / -50...350	°C	–	–
752	Actual value of d.h.w. temperature sensor B31 --- No value available	--- / -50...350	°C	–	–
753	Actual value of d.h.w. temperature sensor B32 --- No value available	--- / -50...350	°C	–	–
754	Actual value of d.h.w. temperature sensor B33 --- No value available	--- / -50...350	°C	–	–
755	Maximum value of d.h.w. temperature B3 To make a reset to the actual value, press the - / + buttons simultaneously for 3 s --- No value available	--- / -50...350	°C	–	–
756	Maximum value of d.h.w. temperature B32 To make a reset to the actual value, press the - / + buttons simultaneously for 3 s --- No value available	--- / -50...350	°C	–	–
<b>Functions</b>					
770	Reduced setpoint of the d.h.w. temperature (TBWR) TBWwLine 26	8...TBWw	°C	..... °C	40
771	Release of d.h.w. heating 0 24 h / day 1 According to the heating circuit time switch program(s) with forward shift 2 According to the d.h.w. time switch program (lines 19...25)	0...2	–	.....	1
772	Selection of program for the circulating pump 0 According to the heating circuit time switch program 1 According to the release of d.h.w. heating (line 771) 2 According to a free time switch program 3 According to the d.h.w time switch program	0...3	–	.....	1
773	Assignment of d.h.w. heating 0 For local consumer only 1 For all consumers in the same segment 2 For all consumers in the system	0...2	–	.....	2
774	Number of d.h.w. charging cycles 0 Once per day (forward shift 2.5 h) 1 Several times per day (forward shift 1h)	0 / 1	–	.....	1
775	Type of d.h.w. demand 0 Sensor 1 Control thermostat	0 / 1	–	.....	0
776	Boost of the flow temperature setpoint for d.h.w.	0...30	K	..... K	16
777	D.h.w. priority 0 MC + PC absolute 1 MC + PC shifting 2 None (parallel) 3 MC shifting, PC absolute	0...3	1	.....	1
778	D.h.w. priority when charging with the buffer storage tank 0 Absolute priority 1 Shifting priority 2 No priority	0...2	–	.....	1
779	Automatic d.h.w. push 0 No 1 Yes	0 / 1	–	.....	0
780	Limitation of the d.h.w. charging time --- OFF	--- / 5...250	min	..... min	150








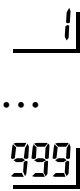
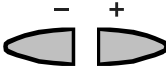

<i>Line</i>	<i>Function</i>	<i>Range</i>	<i>Unit</i>	<i>Resolution</i>	<i>Factory setting</i>
781	Changeover to d.h.w. charging with electric immersion heater --- OFF	--- / 20...80	°C	..... °C	---
<i>Legionella function</i>					
790	Periodicity of the legionella function --- OFF 1...7 Duration / weekday	--- / 1...7	–	.....	7
791	Legionella function strategy 1 Maximum period 2 Fixed period 3 Fixed weekday	1...3	–	.....	1
792	Setpoint of the legionella function	60...95	°C	..... °C	65
793	Time for the legionella function	00:00...24:00	hh:mm	.... : .... hh:mm	18:00
794	Dwelling time at legionella function setpoint --- Function deactivated	--- / 10...360	min.	..... min	30
795	Circulating pump operation during the legionella function 0 No 1 Yes	0 / 1	–	.....	1
<b>General functions</b>					
801	Effect of the green button 1 During d.h.w. heating 2 When space heating is active 3 In both situations	1...3	–	.....	2
803	Frost protection for the plant with the system pump 0 General frost protection for the plant does not act on this pump 1 General frost protection for the plant acts on this pump	0 / 1	–	.....	1
804	Central setpoint compensation --- Function deactivated	1...100	K	..... K	---
<i>LPB / system</i>					
850	LPB device address 0 Standalone 1 Device number	0 / 1	–	.....	1
851	LPB segment address 0 Heat generation segment 1...14 Consumer segments	0...14	–	.....	0
852	LPB power supply 0 OFF (central bus power supply) 1 AUTOMATIC (controller – bus power supply)	0 / 1	–	.....	1
853	Display LPB power supply	ON / OFF	–	–	–
855	Range of action of central changeover 0 In the segment 1 In the system (if segment address = 0)	0 / 1	–	.....	1
856	Automatic summer / winter changeover 0 Effect on local heating circuit only 1 Central changeover of all heating circuits	0 / 1	–	.....	0
857	Central standby switch 0 OFF (inactive) 1 ON (all units on standby)	0 / 1	–	.....	0
860	Outside temperature source -- -- No signal 00.01 Segment / device address	-- --/ 00.01...14.16	–	–	–
<i>Clock</i>					
865	Clock mode 0 Autonomous clock 1 System time without remote adjustment 2 System time with remote adjustment 3 System clock (master)	0...3	–	.....	3
866	Changeover date winter- / summertime	01.01...31.12	tt.mm	.... : .... dd.mm	25.03
867	Changeover date summer- / wintertime	01.01...31.12	tt.mm	.... : .... dd.mm	25.10

Line	Function	Range	Unit	Resolution	Factory setting
<b>Input H1</b>					
870	Function selection input H1 1 Changeover of operating mode (HC standby / d.h.w. OFF) 2 Changeover of operating mode (only HC standby) 3 Minimum setpoint of flow temperature (setting on line 871) 4 Heat generation lock oil / gas or heat pump 5 Heat demand DC 0...10 V 6 Error signal / alarm 7 Green mode 8 Charging priority d.h.w. wood firing 9 Reserved 10 Reserved 11 Heat generation lock heat pump 12 Fault heat pump 13 Fault wood-fired boiler 14 Yield measurement solar	1...14	–	–	1
871	Min. setpoint of flow temperature contact H1 (TVHw) If activated at input H1 (setting 3)	8...TKmax	°C	..... °C	70
872	Max. value of heat demand signal DC 0...10 V (H1) If activated at input H1 (setting 5)	5...130	°C	..... °C	100
873	Operating action of the contact connected to H1 0 N.C. contact 1 N.O. contact	0 / 1	–	.....	1
<b>Input E1</b>					
877	Display of operating hours input E1 To make a reset to 0, press the - / + buttons simultaneously for 3 s	0...999'999	h	–	0
878	Display of number of starts input E1 To make a reset to 0, press the -/+ buttons simultaneously for 3 s	0...999'999	–	–	0
880	Function selection input E1 1 Hours run and start counter 2 Heat generation lock oil / gas 3 Error / alarm message 4 Reserved 5 Heat generation lock heat pump 6 Operating signal for heat pump, hours run and start counter 7 Release of return temperature control of wood-fired boiler 8 Forced charging of buffer storage tank with heat pump	1...8	–	.....	1
881	Operating action of voltage signal at input E1 0 0 V switches ON 1 230 V switches OFF	0 / 1	–	.....	1
<b>Output P1 (PWM)</b>					
885	Assignment of pump P1 1 Solar pump Q5 / K9 2 Pump Q10 of wood-fired boiler 3 Heating circuit pump Q2 4 Reserved	1...4	–	.....	1
886	PWM signal logic 0 Standard 1 Inverted	0 / 1	–	.....	0
887	Display PWM output P1	0...100	%	–	–
888	Output test P1 --- No test 0-100 PWM setpoint in %	--- / 0...100	%	–	---
<b>Output Ux (0...10 V)</b>					
890	Function selection Ux 1 Solar pump Q5 / K9 2 Pump Q10 of wood-fired boiler 3 Heating circuit pump Q2 4 Reserved 5 Setpoint of heat generation 6 Temperature setpoint heat pump 7 Temperature setpoint oil- / gas-fired boiler 8 Temperature setpoint wood-fired boiler	1...8	–	.....	1
891	Maximum value of heat demand (when used as the temperature setpoint)	5...130	°C	1	100
892	Voltage signal logic 0 Standard 1 Inverted	0 / 1	–	.....	0

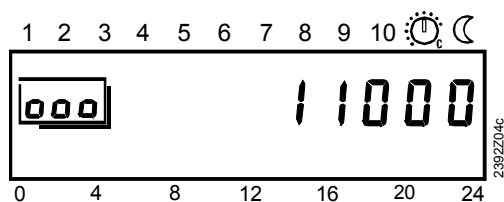
Line	Function	Range	Unit	Resolution	Factory setting
893	Displaying voltage output U <sub>x</sub>	0...100	%	—	—
894	Output test U <sub>x</sub> --- No test 0-100 Voltage setpoint DC 0...10 V (0...100 %)	--- / 0...100	%	—	---
<b>Reset</b>					
899	Resetting the heating engineer parameters to the default values To reset the parameters of the heating engineer level to the default values, press the + / - buttons simultaneously for 3 s	0 / 1	—	—	0

### Parameter settings on the «Experts» level

Settings and protective functions for the experts.

	Buttons	Explanation	Line
1		Press one of the operating line selection buttons. <i>This will first take you to programming level "Enduser".</i>	
2	 9 s	Press both operating line selection buttons for at least 9 seconds. The heating engineer level will appear after 3 seconds and then – after another 6 seconds – the EXP programming level with a special display for entering the code.	
3	<b>CODE</b>	Press buttons  and  to enter the required combination of the access code. <i>If the combination of buttons is correct, you reach programming mode "EXP".</i>  → Wrong code: If the code has been entered incorrectly, the display will return to "Parameterization heating engineer".	
4		Press the operating line selection buttons to select the required line. <i>The following parameter list contains all operating lines on which settings can be made.</i>	
5		Press the + / - button to set the required value.  The setting will be stored as soon as you leave the programming mode or change to another operating line.	
6	<b>Auto</b> 	To leave the EXP programming level, press any of the operating mode buttons. → Note: <i>If no button is pressed for about 8 minutes, the controller will automatically return to the operating mode selected last.</i>	Continuous display

### Access code



Whether correct or incorrect, each push of a button represents irrevocably a digit of the code.

As a confirmation, the respective digit changes to 1.

You receive the code from your local Siemens Building Technologies / HVAC Products sales office.



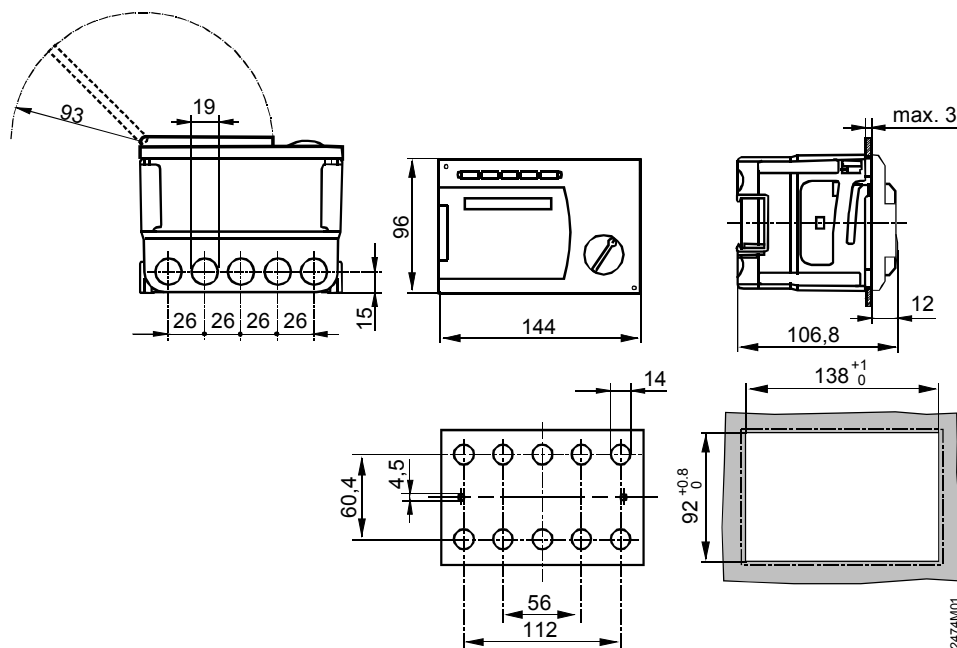
## Overview of the EXP parameters

Line	Function	Range	Unit	Resolution	Factory setting
<b>General EXP</b>					
180	General frost protection 0 Inactive 1 Active	0 / 1	–	.....	1
<b>Oil- / gas-fired boiler EXP</b>					
250	Minimum limitation of boiler temperature setpoint EXP (TKminEXP)	8...95	°C	..... °C	40
251	Max. limitation of the boiler temperature setpoint (TKmax)	8...120	°C	..... °C	80
252	Switching differential of the boiler temperature (SDK)	0...20	K	..... K	8
253	Minimum limitation of the burner running time	0...10	min	..... min	4
254	Release limit of burner stage 2	0...500	K*min	..... K*min	50
255	Reset limit of burner stage 2	0...500	K*min	..... K*min	10
256	Pump overrun time (after burner OFF)	0...20	min	..... min	5
257	Operating mode of the boiler 0 Continuous operation (without extended burner running time) 1 Automatic operation (without extended burner running time) 2 Automatic operation (with extended burner running time)	0...2	–	.....	1
259	Protective boiler startup 0 None 1 With effect on the consumers and on the boiler pump 2 With effect on the consumers 3 With effect on the boiler pump	0...3	–	.....	1
261	Control of the boiler pump 0 According to heat demand 1 Parallel to burner operation	0 / 1	–	.....	0
<i>Minimum limitation of the return temperature</i>					
280	Minimum limitation of boiler return temperature EXP	8...line 252	°C	..... °C	8
281	Maintained boiler return temperature with consumer influence 0 With no effect on the consumers 1 With effect on the consumers	0 / 1	–	.....	1
283	Switching differential of the bypass pump (SDBP)	0...20	K	..... K	6
284	Control of the bypass pump 0 Parallel to burner operation 1 According to the boiler return temperature	0...2	–	.....	0
285	P-band of minimum limitation of the return temperature oil / gas (Xp)	1...100	K	..... K	24
286	Integral action time for minimum limitation of the return temperature oil / gas (Tn)	10...873	s	..... s	90
287	Actuator running time minimum limitation of the return temperature oil / gas	30...873	s	..... s	120
<b>Solar heating plant EXP</b>					
300	Maximum temperature collector 1 --- Overtemperature protection OFF	20...350	°C	..... °C	120
301	Maximum temperature controller 2 --- Overtemperature protection OFF	20...350	°C	..... °C	120
302	Hysteresis of maximum limitation of the collector temperature	1...20	°C	..... °C	5
303	Frost protection temperature collector 1 + 2 --- Frost protection OFF	–20...5	°C	..... °C	---
304	Maximum storage tank charging time	1...60	min	..... min	20
305	Maximum waiting time	1...40	min	..... min	5
307	Changeover / startup delay bypass valve / charging pump K9	1...15	min	..... min	3

Line	Function	Range	Unit	Resolution	Factory setting
<b>Collector pump protection</b>					
310	Evaporation temperature of heat conducting medium --- Function deactivated	--- / 80...350	°C	..... °C	---
311	Switching differential to evaporation temperature of heat conducting medium	1...50	K	..... K	15
<b>Wood-fired boiler EXP</b>					
351	Protective boiler startup 0 No 1 Yes	0 / 1	–	.....	0
<b>Minimum limitation of the return temperature</b>					
380	Minimum limitation of the boiler return temperature	8...140	°C	..... °C	60
381	P-band of minimum limitation of the return temperature	1...100	K	..... K	24
382	Integral action time of minimum limitation of the return temperature	10...873	s	..... s	90
383	Running time of actuator for minimum limitation of the return temperature	30...873	s	..... s	120
<b>Heat pump EXP</b>					
400	Maximum switch-off temperature	20...140	°C	..... °C	55
401	Minimum switch-on temperature --- Function deactivated	--- / 8...95	°C	..... °C	---
410	Prerun time heat pump pump and water / brine pump	5...240	s	..... s	15
411	Overrun time heat pump pump and water / brine pump	5...240	s	..... s	15
413	Minimum compressor running time	0...60	min	..... min	15
414	Minimum compressor off time	0...60	min	..... min	15
415	Automatic switch-on attempt after heat pump errors 135 and 137 0 No 1 Yes	0 / 1	–	.....	1
416	Compensation of surplus heat / heat deficit due to running time 0 Inactive 1 Active	0 / 1	–	.....	1
<b>Second heat pump stage</b>					
420	Locking time heat pump stage 2	1...60	min.	..... min	10
421	Release limit heat pump stage 2	0...500	K*min	..... K*min	50
422	Reset limit heat pump stage 2	0...500	K*min	..... K*min	10
423	Changeover of stage sequence --- Function deactivated 10...990 Automatic changeover based on hours	--- / 10...990	h	..... h	---
<b>Water / brine temperature</b>					
425	Minimum water / brine temperature --- Function deactivated	--- / – 20...20	°C	..... °C	3
426	Switching differential for min. water / brine temperature	1...10	K	..... K	3
<b>Buffer storage tank EXP</b>					
450	Buffer storage tank safety temperature	20...95	°C	..... °C	90
<b>D.h.w. storage tank EXP</b>					
500	D.h.w. storage tank safety temperature	20...95	°C	..... °C	90
<b>Heating circuit EXP</b>					
700	Boost of flow temperature setpoint mixing valve (UEM)	0...50	K	..... K	10
701	Gain factor of room influence (KORR)	0...20	–	.....	4
702	Constant for quick setback (KON) (without room sensor)	0...20	–	.....	2
703	Boost of the room temperature setpoint (with boost heating)	0...20	K	..... K	5
705	Control mode of mixing valve 0 2-position 1 3-position	0 / 1	–	.....	1

Line	Function	Range	Unit	Resolution	Factory setting
706	Switching differential mixing valve (for 2-position mixing valves)	0...20	K	..... K	2
707	Overtemperature protection for the pump heating circuit 0 Inactive 1 Active	0 / 1	–	.....	1
708	Heat gains	-2...4	K	..... K	0
709	Adaption sensitivity 1	1...15	–	.....	15
710	Adaption sensitivity 2	1...15	–	.....	15
711	P-band heating circuit (Xp)	1...100	K	..... K	24
712	Integral action time heating circuit (Tn)	10...873	s	..... s	90
713	Actuator running time heating circuit	30...873	s	..... s	120
<b>D.h.w. EXP</b>					
750	Maximum nominal setpoint of the d.h.w. temperature (TBWmax)	8...80	°C	..... °C	60
751	Switching differential of the d.h.w. temperature (SDBW)	0...20	K	..... K	5
752	D.h.w. discharge protection when charging with the wood-fired boiler 1 Supervision of sensor of the wood-fired boiler 2 Supervision of sensor of the wood-fired boiler and buffer storage tank	1 / 2	–	.....	1
753	D.h.w. discharge protection when charging with the oil- / gas-fired boiler 0 Inactive 1 Supervision of sensor of the oil- / gas-fired boiler 2 Supervision of sensor of the oil- / gas-fired boiler and buffer storage tank	0...2	–	.....	1
<b>General / service EXP</b>					
800	Software version	00.0...99.9	–	–	–
801	Device operating hours	0...999'99 9	h	–	–
802	Resetting the OEM parameters To reset the parameters of the OEM level to their default values, press the + / - buttons simultaneously for 3 s	0 / 1	–	–	0
803	Display version table with basic diagrams	0...32'767	–	–	–

## Dimensions



2474M01

Dimensions in mm

