SIEMENS

Albatros^2
Solar compact controller
User manual

RVA78.690

CE1U2396en
18.08.2010

Building Technologies

Siemens Switzerland Ltd
Industry Sector
Building Technologies Division
Gubelstrasse 22
6301 Zug
Switzerland
Tel. +41 41-724 24 24
www.siemens.com/sbt

Table of contents

1 Summary

This user's guide describe operating and configuring the solar compact controller RVA 78.690 for readers ranging from users to heating technicians up to OEM customers.

The following products are described in separate pieces of documentation:

QAD36	Strap-on temperature sensor NTC 10 kΩ	Q1801
QAZ36	Immersion temperature sensor NTC 10 kΩ	Q1842

2 Safety notes

2.1 Notes on product liability

- The device may only be used in building services plant and applications as described in this document
- Comply with all requirements specified in chapters "Handling" and "Technical data" when using the device.
- Local regulations (for installation, etc.) must be complied with
- Do not open the device. If not observed, warranty becomes void.

3 Mounting and installation

3.1 Regulations

3.1.1 Electrical installation

- Prior to installing the units, power must be turned off
- The connections for mains and low-voltage are separated
- The wiring must be made in compliance with the requirements of safety class II. This means that sensor and mains cables must not be run in the same duct

3.2 Planning

- Air circulation around the controller must be ensured, allowing the unit to emit the heat produced by it.
- The controller is designed to conform to the directives for safety class II devices mounted in compliance with these regulations.
- Power to the controller may only be supplied when fully mounted / electric installation is complete. If this is not observed, there is risk of electric shock near the terminals
- The controller must not be exposed to dripping water
- Permissible ambient temperature when mounted and when ready to operate: 0…50 °C
- Power cables must be clearly separated from low-voltage cables (sensors) observing a distance of at least 100 mm

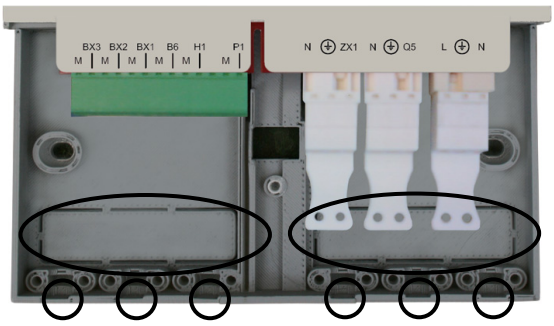
3.3 Mounting

Mounting location

- Wall mounting
- Control panel

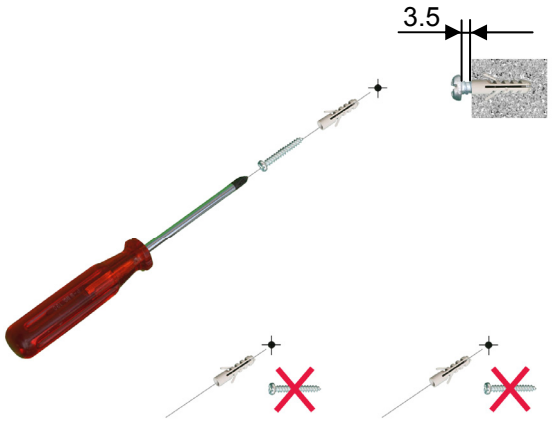
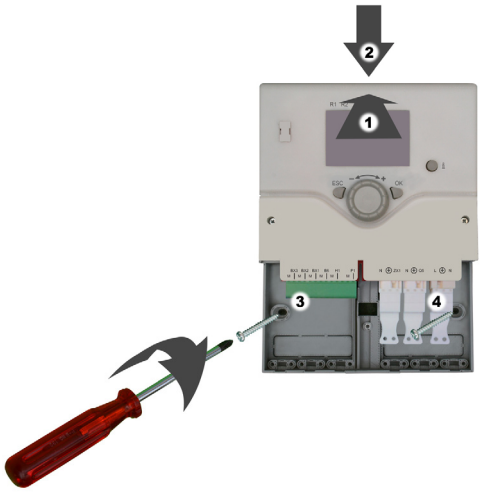
Prepare for mounting

The device has two pre-punched connection openings on the back side and six on the under side. Break out the required connection openings prior to mounting.

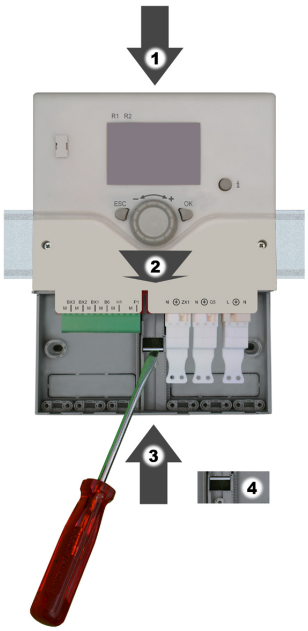


3.3.1 Mounting method

Wall mounting

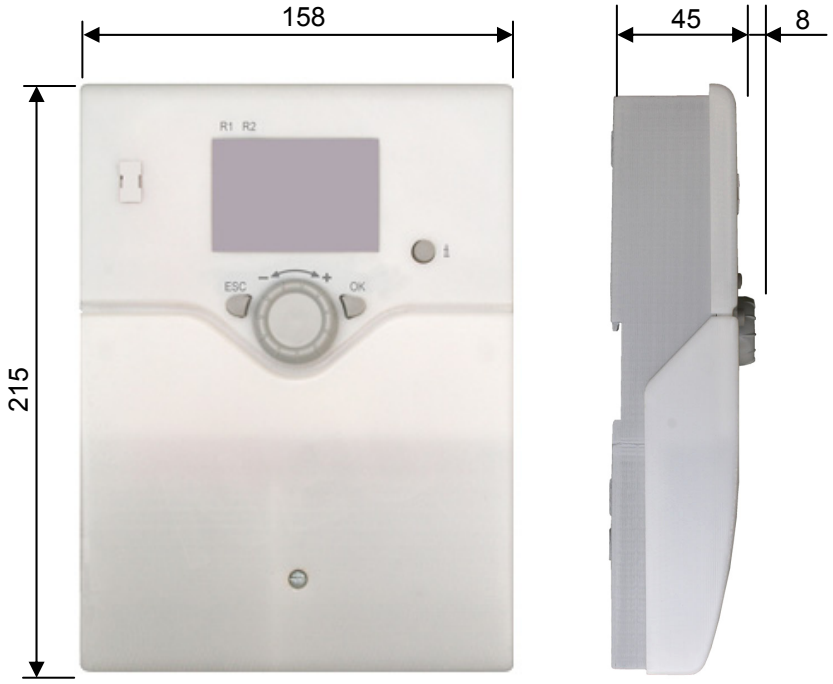
Drill holes per image (see. page 7)	Insert all brads (as needed). Screw in the first screw to a distance of 3.5 mm
	
Place the device on the protruding screws (1) and press down gently (2). Attach using the remaining two screws (3 and 4)	

On DIN rail

A socket is located on the base to mount on a DIN rail. Attach the device with the upper portion on the DIN rail (1) and press on the lower part of the rails (2). Push the attachment fastening slide to (3) to the end position (4).	

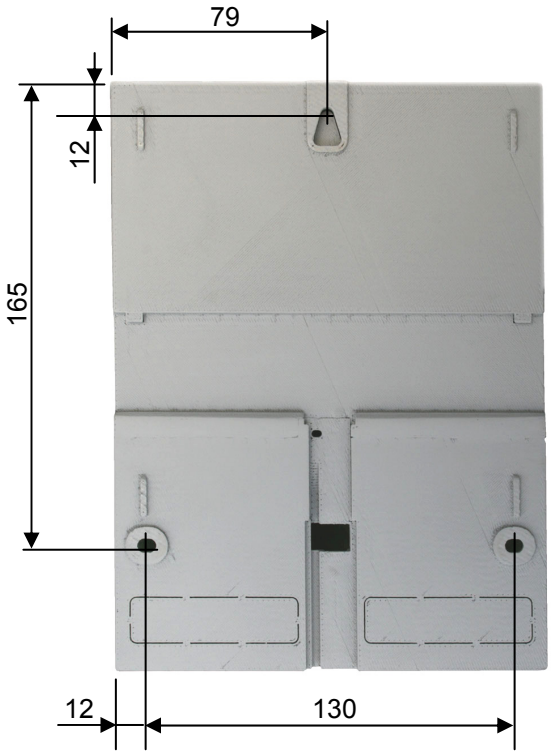
3.3.2 Dimensions and drilling plan

Dimensions



Measures in mm

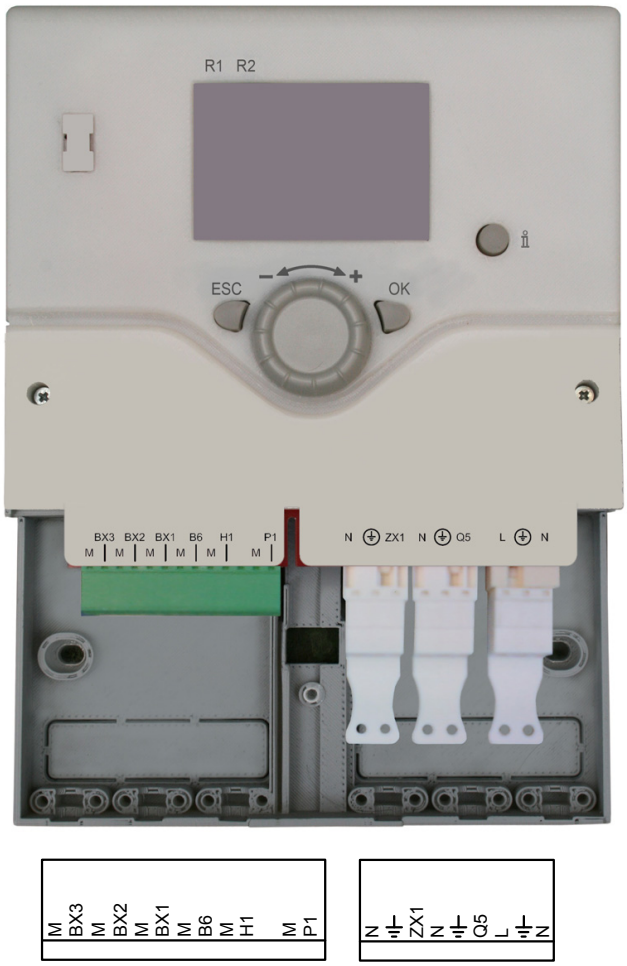
Drilling plan



Measures in mm

3.3.3 Connection terminals

A special connector is used for wiring; it is plugged into the plug on the controller.
Plug assignment per image below:



3.3.3.1 Terminal markings

Low-voltage

	Use	*Connector type*
M BX3	Ground Multifunctional sensor input 3	supplies, 13-pin plug
M BX2	Ground Multifunctional sensor input 2	
M BX1	Ground Multifunctional sensor input 1	
M B6	Ground Collector sensor 1	
M H1	Ground Digital input (pulse measurement)	
M P1	Ground Output pulse width modulation (PWM)	

Mains voltage

	Use	*Space*	*Connector type*
N ⏚ ZX1	Neutral conductor Protective earth Multifunctional output (Triac)	U	AGP8S.03C/109
N ⏚ Q5	Neutral conductor Protective earth Collector pump 1 (Triac)	U	AGP8S.03C/109
L ⏚ N	Live AC 230 V basic unit Protective earth Neutral conductor	N ⏚ L	AGP4S.03E/109

4 Commission

Prerequisites

To commission the units, the following working steps must be carried out:

- Make certain that mounting and electrical installation are in compliance with the relevant requirements.
- Make all plant-specific settings. Special attention must be paid to menu "Configuration". For that purpose, the relevant operating level is selected as follows:
- Press the OK button to switch to programming.
- Press the Info button for at least 3 seconds and select operating level "Commissioning" with the setting knob. Then, press the OK button.
- Make the function check as described below

Function check

To facilitate commissioning and fault tracing, the controller can be used to make input and output tests. With these tests, the controller's inputs and outputs can be checked. To make the tests, switch to menu "Input / output test" and go through all available setting lines.

Operating state

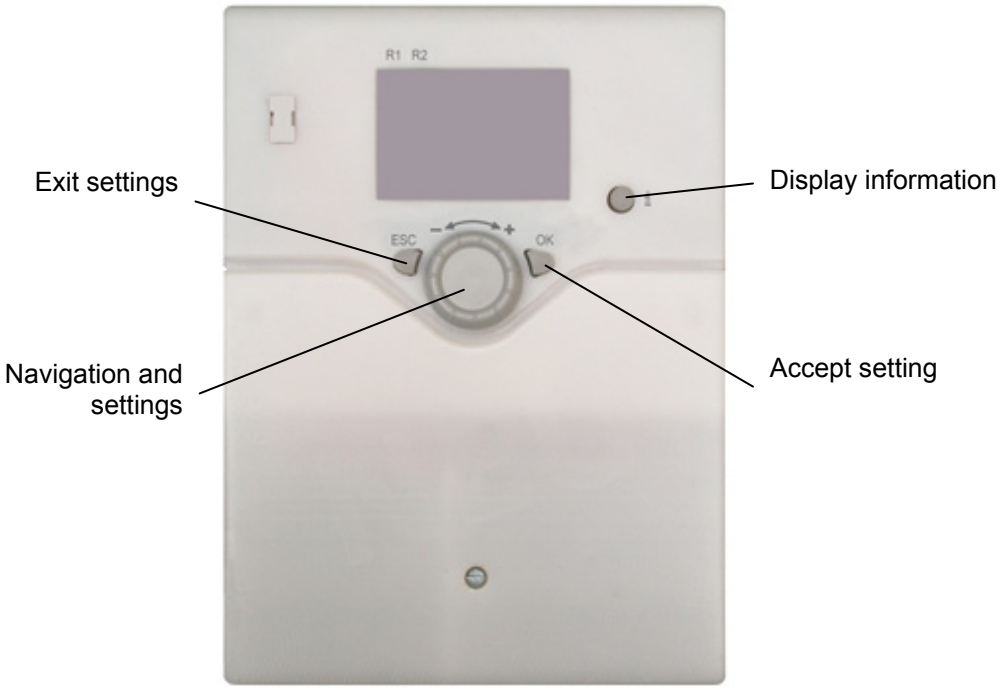
The current operating state can be checked on menu "State".

Diagnosis

For detailed diagnostics of the plant, check menus "Diagnostics heat generation" and "Diagnostics consumers".

5 Handling

5.1 Operating elements



The knob navigates through setting and navigation lines as well as adjusts setting values.

The Info button enters the info level.

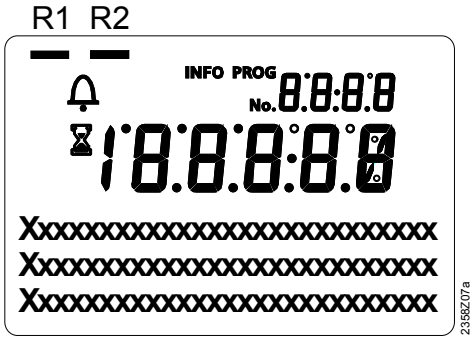
The OK button enters the selected menu or setting lines. Confirm a set value with OK.

The Escape button changes to the next highest level without saving values from the previous level.

5.2 Display

Full display

View of all display segments:

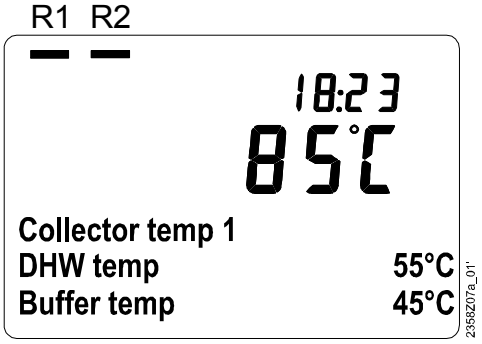


Display choices

R1	Output Q5 is enabled.	**INFO**	Info level activated
R2	Output ZX1 is enabled.	**PROG**	Programming activated
	Error messages	**No**	Operating line numbers
	Process running – please wait		

Basic display

View in normal operation:

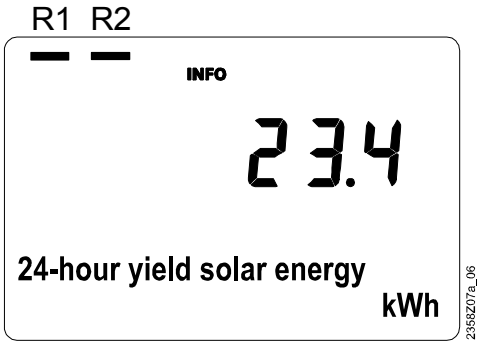


The three most important temperatures for the selected diagram are displayed in the basic display. It is a selection of the following temperature measured values:

- Collector temp 1
- Collector temp 2
- DHW temp 2
- Buffer temp 2

5.3 Displaying information

Various data can be displayed by pressing the info button.

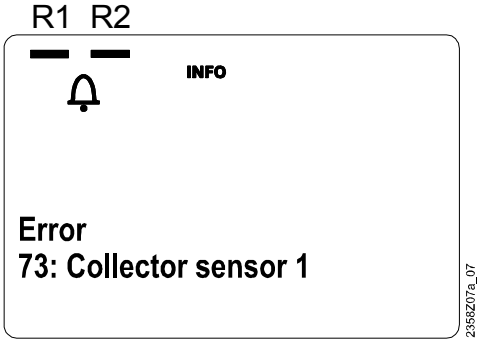


Display values (if available):

- 24-hour yield solar energy
- Total yield solar energy
- DHW temp 1
- Solid fuel boiler temp
- Buffer temp 1
- State DHW
- State solar
- State solid fuel boiler
- State buffer

Error messages

A plant fault is visualized in the basic display using the error icon 🔔.
Press the info button and read further information.



A list of possible displays is available under "Display lists" on page 47.

5.4 Programming

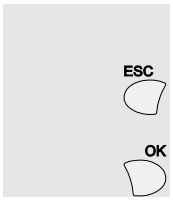
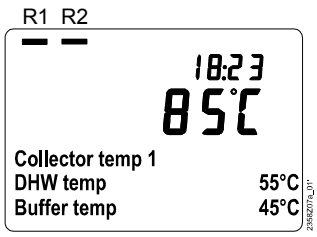
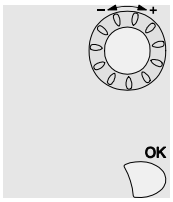
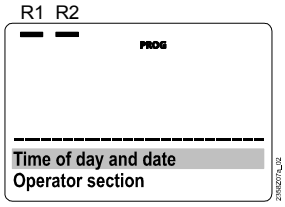
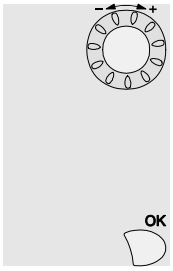
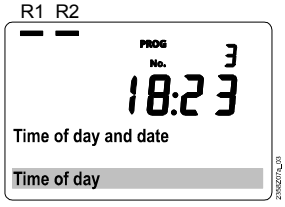
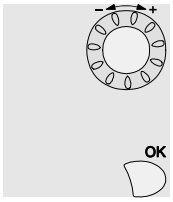
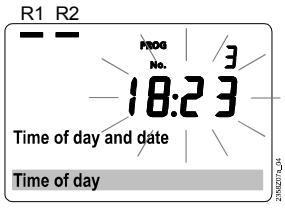
5.4.1 Setting principle

Settings that cannot be made directly with the help of operating elements are made through programming. For this purpose, the individual settings are structured in the form of menus and operating lines, thus creating practical groups of settings.

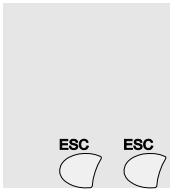
The following example shows how to set the time of day and the date.

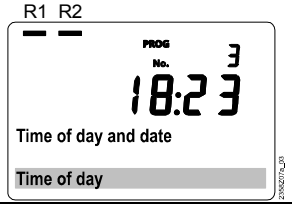
5.4.2 Example: "Setting the time of day"

- Press *OK* to go to programming.
- Press the ESC button to go one step back at a time, readjusted values are not adopted
- If no setting is made for 8 minutes, the display returns automatically to the basic display
- Operating lines may be hidden, depending on configuration and user level

	Operation	Display example	Description
1			Basic display. If the basic display is not shown, press the ESC button to go back. Press OK.
2			The bottom section of the display shows various menus. Turn the setting knob until menu *Time of day and date* appears. Press the OK button to confirm.
3			In the bottom section of the display, the first operating line of menu *Time of day and date* appears. Turn the setting knob to *Time of day*. Press the OK button to confirm.
4			The clock flashes on the display. Turn the setting knob to the correct time. Press the OK button to confirm.

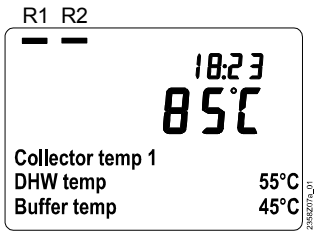
5





The settings are saved and the displays stops blinking.
Now, you can make further settings or
Press ESC twice to go to the basic display.

6



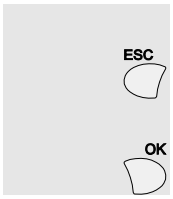
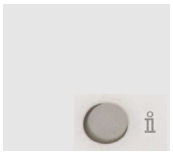
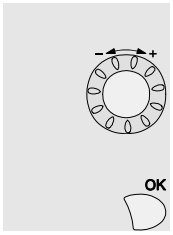
Returns to the basic display.

Example of menu structure

Time of day and date	➡	Year		
Operator section		Date		
Time program		**Time of day**	➡	**00:00 - 23:59**

5.5 User levels

The user levels only allow authorized target groups to make settings.
To reach the required user level, proceed as follows:

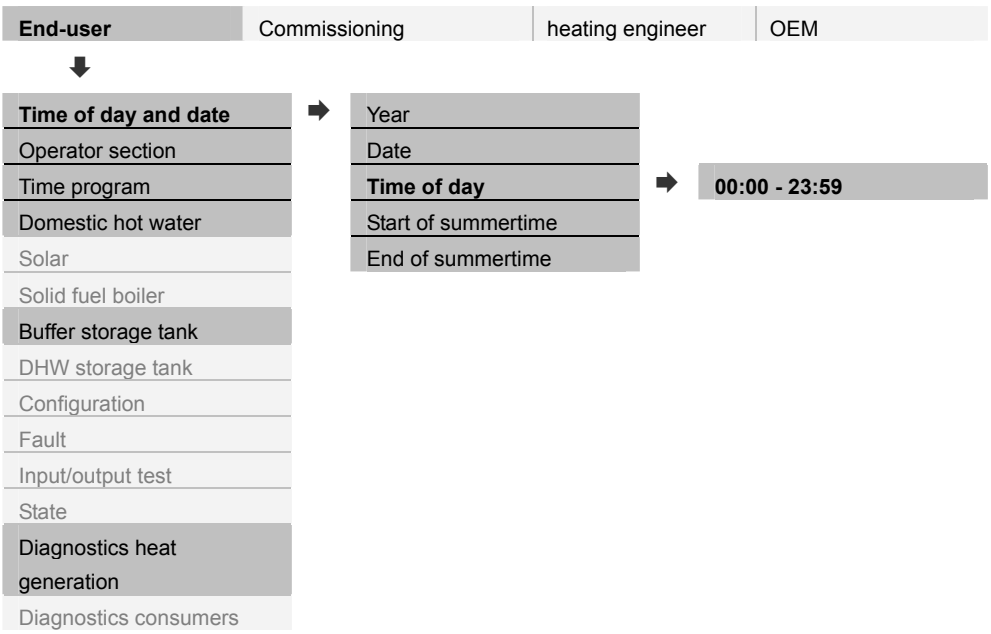
	Operation	Display example	Description
1		R1 R2 18:23 85°C Collector temp 1 DHW temp 55°C Buffer temp 45°C	Basic display. If the basic display is not shown, press the ESC button to go back. Press OK.
2		R1 R2 PROG Time of day and date Operator section	You are in programming for user level "End user". Press the info button for 3 seconds.
3		R1 R2 PROG End-user Commissioning	You are now given a choice of user levels. Turn the setting knob until the required user level is reached. Press OK.
4		R1 R2 PROG Time of day and date Operator section	You are now at the required user level.

To reach the OEM level, the relevant code must be entered.

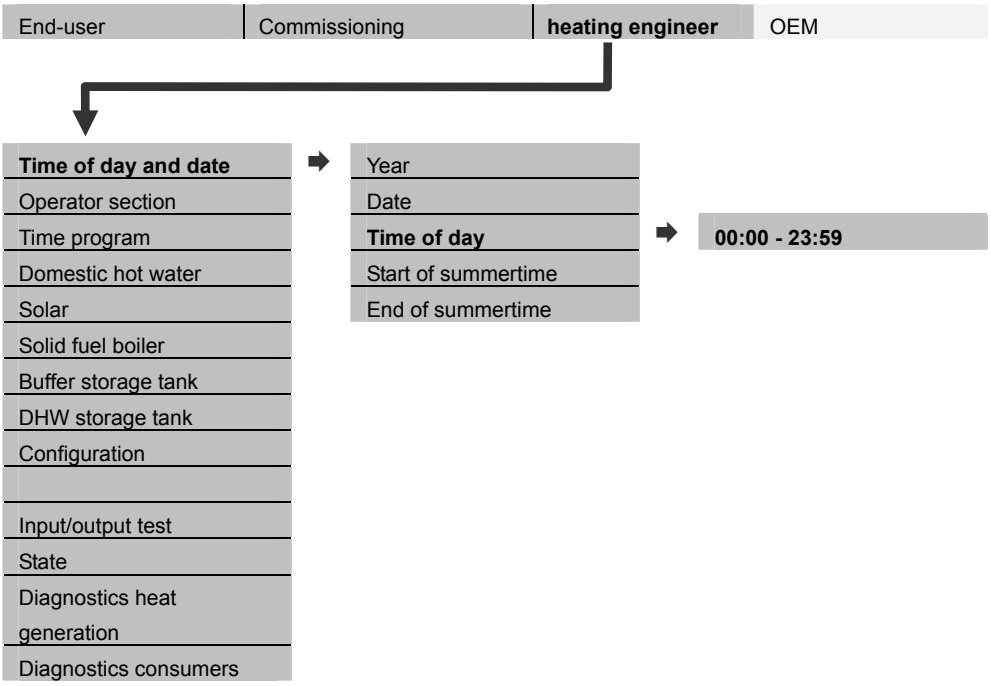
5.5.1 Setting structure "End user"

The following two examples illustrate setting displays depending on the selected user level.

Adjustable
Hidden at this level
Bold = selected level / line



5.5.2 Setting structure "Heating engineer"



5.6 Overview of the settings

The table below shows all available settings up to the heating engineer level. However, certain operating lines may be hidden, depending on the type of unit.

Key E = End user I = commissioning F = heating engineer O = OEM
BZ = Operating line

Operating line	User level	Function	Default value	Min	Max	Unit
Time of day and date						
1	E	Year	-	2004	2099	yyyy
2	E	Date	-	01.01	31.12	dd.MM
3	E	Time of day	-	00:00	23:59	hh:mm
5	F	Start of summertime	25.03	01.01	31.12	dd.MM
6	F	End of summertime	25.10	01.01	31.12	dd.MM
Operator section						
20	E	Language German ¦ …	German			-
24	O	Lighting Off ¦ Temporarily* ¦ Permanently	Temporarily			-
27	F	Programming lock Off ¦ On	Off.			-
Time program						
501	E	1. phase on	6:00	00:00	24:00	hh:mm
502	E	1. phase off	22:00	00:00	24:00	hh:mm
503	E	2. phase on	24:00	00:00	24:00	hh:mm
504	E	2. phase off	24:00	00:00	24:00	hh:mm
505	E	3. phase on	24:00	00:00	24:00	hh:mm
506	E	3. phase off	24:00	00:00	24:00	hh:mm
730	E	Summer/winter heating limit	18	8	30	°C
Domestic hot water						
1600	E	Operating mode Off ¦ On ¦ Eco	On.			-
1610	E	Nominal setpoint	55	Operating line 1612	BZ 1614 OEM	°C
1612	F	Reduced setpoint	40	8	Operating line 1610	°C
1614	O	Nominal setpoint max	65	8	80	°C
1620	I	Release 24h/day ¦ Time program	Time program			-
1640	F	Legionella function Off ¦ Periodically	Periodically			-
1641	F	Legionella funct periodically	3	1	7	Days
1644	F	Legionella funct time	– – –	– – – / 00:00	23:50	hh:mm
1645	F	Legionella funct setpoint	65	55	95	°C
1646	F	Legionella funct duration	30	– – – / 10	360	min
1647	F	Legionella funct circ pump Off ¦ On	On.			-
1660	F	Circulating pump release 24h/day ¦ Switching program	Switching programs			-

Operating line	User level	Function	Default value	Min	Max	Unit
1661	F	Circulating pump cycling Off ¦ On	On.			-
1663	F	Circulation setpoint	45	8	80	°C
Solar						
3810	F	Temp diff on	8	0	40	°C
3811	F	Temp diff off	4	0	40	°C
3812	F	Charg temp min DHW st tank	– – –	– – – / 8	95	°C
3813	O	Temp diff on buffer	– – –	– – – / 0	40	°C
3814	O	Temp diff off buffer	– – –	– – – / 0	40	°C
3815	F	Charging temp min buffer	– – –	– – – / 8	95	°C
3822	F	Charging prio storage tank None ¦ DHW storage tank ¦ Buffer	DHW storage tank			
3825	F	Charging time relative prio	– – –	– – – / 2	60	min
3826	F	Waiting time relative prio	5	1	40	min
3827	F	Waiting time parallel op	– – –	– – – / 0	40	min
3828	F	Delay secondary pump	60	0	600	s
3830	F	Collector start function	– – –	– – – / 5	60	min
3831	F	Min run time collector pump	20	5	120	s
3832	O	Collector start function on	07:00	00:00	23:50	hh:mm
3833	O	Collector start function off	19:00	00:00	23:50	hh:mm
3834	F	Collector start funct grad	– – –	– – – / 1	20	Min/°C
3840	F	Collector frost protection	– – –	– – – / -20	5	°C
3850	F	Collector overtemp prot	– – –	– – – / 30	350	°C
3860	F	Evaporation heat carrier	– – –	– – – / 60	350	°C
3870	F	Pump speed min	40	0	100	%
3871	F	Pump speed max	100	0	100	%
3872	O	Speed Xp	32	1	100	°C
3873	O	Speed Tn	120	10	873	s
3880	F	Antifreeze None ¦ Ethylene glycol ¦ Propylene glycol ¦ Ethyl and propyl glycol	None			
3881	F	Antifreeze concentration	30	1	100	%
3884	F	Pump capacity	– – –	– – – / 10	1500	l/h
3887	F	Pulse unit yield None ¦ kWh ¦ Liter	0	0	2	-
3888	F	Pulse value yield numer	10	1	1000	-
3889	F	Pulse value yield denom	10	1	1000	-
3896	F	Readj solar flow sensor	0	-20	20	°C
3897	F	Readj solar return sensor	0	-20	20	°C
Solid fuel boiler						
4110	F	Setpoint min	40	8	120	°C
4130	F	Temp diff on	8	1	40	°C
4131	F	Temp diff off	4	0	40	°C
4133	F	Comparative temp DHW sensor B3 ¦ DHW sensor B31 ¦ Buffer sensor B4 ¦ Buffer sensor B41 ¦ Flow temp setpoint ¦ Setpoint min	Setpoint min			-
4140	O	Pump overrun time	20	0	120	min
Buffer storage tank						
4700	E	Nominal setpoint	55	8	80	°C

Operating line	User level	Function	Default value	Min	Max	Unit
4701	I	Release 24h/day ¦ Switching program	Switching program			-
4720	F	Auto generation lock None ¦ With B4 ¦ With B4 and B41	With B4			-
4721	O	Auto heat gen lock SD	8	0	20	°C
4750	F	Charging temp max	80	8	95	°C
4751	O	Storage tank temp max	90	8	95	°C
4755	F	Recooling temp	70	8	95	°C
4757	F	Recooling collector Off ¦ Summer ¦ Always	Off.			
4783	F	With solar integration No ¦ Yes	Yes			
4790	F	Temp diff on return div	10	0	40	°C
4791	F	Temp diff off return div	5	0	40	°C
4795	F	Compar temp return div B4 ¦ B41	B41			
4796	F	Optg action return diversion Temp decrease ¦ Temp increase	Temp increase			
4860	F	Min buffer transfer temp	50	20	70	°C
DHW storage tank						
5021	F	Transfer boost	8	0	30	°C
5024	O	Switching diff	5	0	20	°C
5030	O	Charging time limitation	150	– – – / 10	600	min
5050	F	Charging temp max	80	8	BZ 5051 OEM	°C
5051	O	Storage tank temp max	90	8	95	°C
5055	F	Recooling temp	70	8	95	°C
5057	F	Recooling collector Off ¦ Summer ¦ Always	Off.			-
5060	F	El imm heater optg mode Summer ¦ Always	Always			-
5061	F	El immersion heater release 24h/day ¦ Switching program	24h / day			-
5062	F	El immersion heater control External thermostat ¦ DHW sensor	DHW sensor			-
5070	O	Automatic push Off ¦ On	On.			
5093	F	With solar integration No ¦ Yes	Yes			
5130	O	Transfer strategy Always ¦ DHW release	Always			
Configuration						
5700	I	Presetting	-	1	5	-
5840	I	Solar controlling element Charging pump ¦ Diverting valve	Charging pump			
5890	I	Relay output ZX1 None ¦ Circulating pump Q4 ¦ Collector pump 2 Q16 ¦ Solar ctrl elem buffer K8 ¦ Ext heat exchanger K9 ¦ alarm output K10 ¦ Storage tank transfer pump Q11 ¦ Buffer return valve Y15 ¦ Solid fuel boiler pump Q10 ¦ El imm heater DHW K6 ¦ Heat request K27 ¦ Overtemperature protection K11	None			-

Operating line	User level	Function	Default value	Min	Max	Unit
5930	I	Sensor input BX1 None ¦ DHW sensor B3 ¦ DHW sensor B31 ¦ Buffer st tank sensor B4 ¦ Buffer st tank sensor B41 ¦ Collector sensor 2 B61 ¦ Solar flow sensor B63 ¦ Solar return sensor B64 ¦ Common return sensor B73 ¦ Solid fuel boiler sensor B22 ¦ DHW circulation sensor B39	None			-
5931	I	Sensor input BX2 None ¦ DHW sensor B3 ¦ DHW sensor B31 ¦ Buffer st tank sensor B4 ¦ Buffer st tank sensor B41 ¦ Collector sensor 2 B61 ¦ Solar flow sensor B63 ¦ Solar return sensor B64 ¦ Common return sensor B73 ¦ Solid fuel boiler sensor B22 ¦ DHW circulation sensor B39	None			-
5932	I	Sensor input BX3 None ¦ DHW sensor B3 ¦ DHW sensor B31 ¦ Buffer st tank sensor B4 ¦ Buffer st tank sensor B41 ¦ Collector sensor 2 B61 ¦ Solar flow sensor B63 ¦ Solar return sensor B64 ¦ Common return sensor B73 ¦ Solid fuel boiler sensor B22 ¦ DHW circulation sensor B39	None			-
6085	F	Function output P1 None ¦ Per output Q5 ¦ Per output ZX1	None			-
6097	F	Sensor type collector NTC ¦ Pt 1000	NTC			
6098	F	Readjustm collector sensor	0	-20	20	°C
6099	F	Readjustm coll sensor 2	0	-20	20	°C
6200	I	Save sensors No ¦ Yes	No			-
6204	O	Save parameters No ¦ Yes	No			
6205	F	Reset to default parameters No ¦ Yes	No			-
6207	F	Heat request K27 For DHW ¦ for buffer storage tank	For DHW			-
6208	F	Excess heat dischar sensor With B3 ¦ with B31 ¦ with B4 ¦ with B41 ¦ with B6	With B3			-
6209	F	Excess heat discharge temp	80	20	90	°C
6210	F	Swi diff excess heat disch	2	0	20	°C
6220	F	Software version	-	0	99	-
6222	O	Device hours run	0	0	65535	h
Fault						
6710	I	Reset alarm relay No ¦ Yes	No			-
6800	F	History 1	-			
	F	Error code 1	-	0	255	-
6802	F	History 2	-			
	F	Error code 2	-	0	255	-
6804	F	History 3	-			
	F	Error code 3	-	0	255	-
6806	F	History 4	-			
	F	Error code 4	-	0	255	-
6808	F	History 5	-			
	F	Error code 5	-	0	255	-
6820	O	Reset history No ¦ Yes	No			-

Operating line	User level	Function	Default value	Min	Max	Unit
Input/output test						
7705	I	Mod setpoint Q5 relay test	100	0	100	%
7708	I	Modulation signal Q5 test	0	0	100	%
7711	I	Mod setpoint ZX1 relay test	100	0	100	%
7712	I	Modulation signal ZX1 test	0	0	100	%
7750	I	Collector temp B6	-	-28.0	350	°C
7820	I	Sensor temp BX1	-	-28.0	350	°C
7821	I	Sensor temp BX2	-	-28.0	350	°C
7822	I	Sensor temp BX3	-	-28.0	350	°C
7842	I	Pulse counter H1	0		65535	-
State						
8003	I	State DHW	-			-
8007	I	State solar	-			-
8008	I	State solid fuel boiler	-			
8010	I	State buffer	-			
Diagnostics heat generation						
8505	F	Speed collector pump 1	0	0	100	%
8506	F	Speed solar pump ext exch	0	0	100	%
8507	F	Speed solar pump buffer	0	0	100	%
8510	I	Collector temp 1	-	-28.0	350	°C
8511	I	Collector temp 1 max	0	-28.0	350	°C
8512	I	Collector temp 1 min	0	-28.0	350	°C
8513	I	dt collector 1/DHW	-	-168.0	350	°C
8514	I	dt collector 1/buffer	-	-168.0	350	°C
8519	I	Solar flow temp	0	-28.0	350	°C
8520	I	Solar return temp	0	-28.0	350	°C
8526	E	24-hour yield solar energy	0	0	999.9	kWh
8527	E	Total yield solar energy	0	0	9999999.9	kWh
8530	F	Hours run solar yield	0	00:00:00	2730:15:00	hh:mm:ss
8531	F	Hours run collect overtemp	0	00:00:00	2730:15:00	hh:mm:ss
8543	F	Speed collector pump 2	0	0	100	%
8547	I	Collector temp 2	0	-28	350	°C
8548	I	Collector temp 2 max	-28	-28	350	°C
8549	I	Collector temp 2 min	3500	-28	350	°C
8550	I	dt collector 2/DHW	0	-168	350	°C
8551	I	dt collector 2/buffer	0	-168	350	°C
8560	I	Solid fuel boiler temp	0	0	140	°C
8570	E	Hours run solid fuel boiler	0	00:00:00	2730:15:00	hh:mm:ss
Diagnostics consumers						
8703	I	Outside temp attenuated	-	-50	50	°C
8830	I	DHW temp 1	-	0.0	140	°C
8831	I	DHW temp setpoint	-	8.0	80	°C
8832	I	DHW temp 2	-	0.0	140	°C
8835	I	DHW circulation temp	-	0.0	140	°C
8980	I	Buffer temp 1	-	0.0	140.0	°C
8981	I	Buffer setpoint	0	0	140	°C
8982	I	Buffer temp 2	0	0	140	°C

6 The settings in detail

6.1 Time of day and date

The controller has a yearly clock with time of day, weekday and date. To ensure the controller's functionality, both the time of day and the date must be correctly set.

Line no.	*Operating line*
1	**Year**
2	**Date**
3	**Time of day**
5	**Start of summertime**
6	**End of summertime**

Daylight saving time/standard time changeover

The dates set for the changeover from wintertime to summertime, and vice versa, ensure that on the first Sunday after the set date the time of day will change from 02:00 (wintertime) to 03:00 (summertime), and from 03:00 (summertime) to 02:00 (wintertime).

6.2 Operator section

6.2.1 Operation and display

Line no.	*Operating line*
20	**Language**
24	**Lighting** Off Temporarily Permanently
27	**Programming lock**

Lighting

Defines mode of backlit display:

- Off
  No backlight
- Temporarily
  Backlit display automatically switches off after 8 minutes.
- Permanently
  Display backlight is permanently turned on.

Programming lock

Parameter values can still be displayed, but not changed if the programming lock is enabled.

- Temporary deactivation of programming.
  Within the programming level, the programming lock can temporarily be overridden. To do this, press the OK and ESC buttons simultaneously for 3 seconds. Temporary deactivation of the programming lock is maintained until programming is quit.
- Constant deactivation of programming.
  First, make the temporary deactivation, then go to operating line "Programming lock" (27) and deactivate the programming lock

6.3 Time program

The following function can use the time program:

- Enable DHW charging, BZ1620
- Enable DHW circulating pump, BZ1660
- Enable DHW electric immersion heater, BZ5061

A enable takes place (Phase on) or removed (Phase off) at the set times. For DHW, a change between nominal and reduced setpoint at the switching times.

Switching points

Line no.	*Operating line*
501	**1. phase on**
502	**1. phase off**
503	**2. phase on**
504	**2. phase off**
505	**3. phase on**
506	**3. phase off**

6.4 Automatic summer / winter recognition

Line no.	*Operating line*
730	**Summer/winter heating limit**

The controller automatically determines the state summer / winter.

It analyzes the temperature measured on the collector at night, and establishes an average temperature and filters it using a building time constant.

It the resulting temperature is above the summer / winter heating limit set here, the controller interprets is as summer; otherwise winter.

There is no need to charge the buffer in summer, since no heating requests are pending. Conversely, the electric immersion heating in the DHW may be enabled in summer whereas it is locked in winter.

6.5 Domestic hot water

6.5.1 Operating mode

Line no.	*Operating line*
1600	**Operating mode** Off On Eco

Off
DHW is not heated.
Frost protection always remains active, however.

On
The DHW is automatically heated per further settings.

Eco
Controllable heat sources are only used if DHW temperature drops below the reduced setpoint (1612). Otherwise, collectors and the solid fuel boiler is used to charge.

- The level per operating mode ON applies to heat transfer from the buffer
- The level per operating mode ON applies to DHW circulating function
- The automatic push is switched off; manual push remains, however, possible

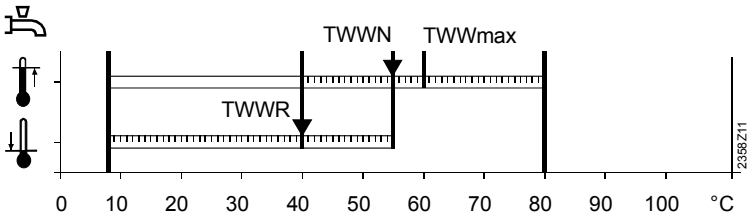
For the Legionella function, controllable heat sources – as needed – are added.

6.5.2 Setpoints

Line no.	*Operating line*
1610	**Nominal setpoint**
1612	**Reduced setpoint**
1614	**Nominal setpoint max**

Nominal setpoint / Reduced setpoint

The DHW can be heated up according to different setpoints. These setpoints are activated depending on the selected operating mode, thus leading to different temperature levels in the DHW storage tank.



TWWR Reduced DHW setpoint
TWWN Nominal DHW setpoint
TWWmax Nominal DHW setpoint maximum

Nominal setpoint maximum

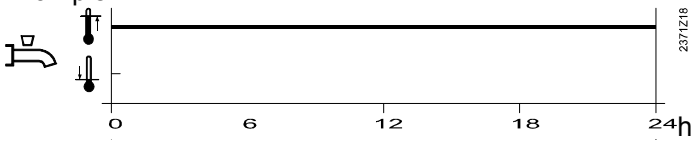
This operating line is used to limit the "Nominal setpoint" (1610) at the top.

6.5.3 Release

Line no.	*Operating line*
1620	**Release** 24h / day Switching program

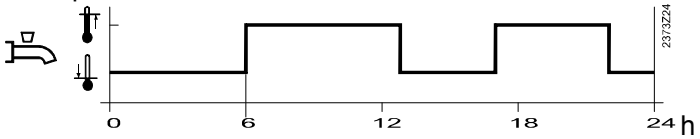
24h / day
The DHW temperature is constantly maintained at the nominal DHW setpoint, independent of any time programs.

Example:



Switching program
The DHW setpoint is switched between the nominal DHW setpoint and the reduced DHW setpoint according to the time programs.

Example:



6.5.4 Legionella function

Line no.	*Operating line*
1640	**Legionella function** Off Periodically
1641	**Legionella funct periodically**
1644	**Legionella funct time**
1645	**Legionella funct setpoint**
1646	**Legionella funct duration**
1647	**Legionella funct circ pump**

Legionella function

Off
Legionella function is not conducted

Periodically
The legionella function is repeated according to the interval set (1641). The legionella setpoint is attained via a solar plant, independent of the period of time set, the period of time will be newly started.

Legionella funct circ pump

During the period of time the legionella function is performed, the DHW circulating pump can be activated.

⚠

During the period of time the legionella function is carried out, there is a risk of scalding when opening the taps.

6.5.5 Circulating pump

Line no.	*Operating line*
1660	**Circulating pump release** 24h / day Switching program
1661	**Circulating pump cycling**
1663	**Circulation setpoint**

Circulating pump cycling

When the function is activated, the circulating pump is switched on for a fixed time of 10 minutes within the release time and then switched off again for 20 minutes.

Circulation setpoint

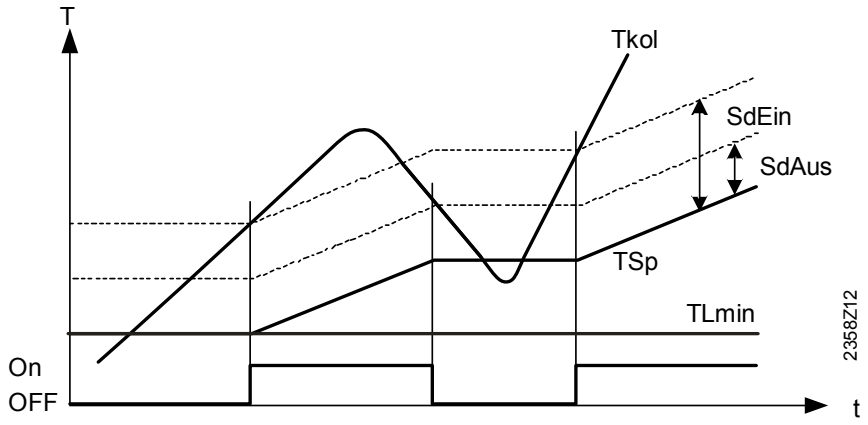
If a sensor is installed in the DHW distribution pipe, the controller monitors its actual value during the period of time the legionella function is performed. The adjusted setpoint must be maintained at the sensor during the adjusted "Dwelling time".

6.6 Solar

6.6.1 Charging controller (dT)

Line no.	*Operating line*
3810	**Temp diff on (DHW storage tank)**
3811	**Temp diff off (DHW storage tank)**
3812	**Charg temp min DHW st tank**
3813	**Temp diff on buffer**
3814	**Temp diff off buffer**
3815	**Charging temp min buffer**

For charging the storage tank via the heat exchanger, the temperature differential between collector and storage tank and collector must achieve the minimum charging temperature for the corresponding storage tank.



Tkol Collector temp
On / Off Collector pump
SdOn Temperature differential on
SdOff Temperature differential off
TSp Storage tank temperature (DHW storage tank or buffer)
TLmin Charging temp. min (DHW storage tank or buffer)

Setting - - - in operating lines 3813 and 3814, adopts the general temperature differential of solar operating lines 3810 and 3811.

6.6.2 Priority

Line no.	*Operating line*
3822	**Charging prio storage tank** None DHW storage tank Buffer storage tank
3825	**Charging time relative prio**
3826	**Waiting time relative prio**
3827	**Waiting time parallel op**
3828	**Delay secondary pump**

Charging prio storage tank

If a plant uses several heat exchangers, it is possible to set a priority for the integrated storage tanks, which defines the charging sequence.

None
Every storage tank is charged alternately for a temperature increase of 5 °C at a time, until every setpoint of level A, B or C (see below) is reached. The setpoints of the next higher level are approached only when all setpoints of the previous level have been reached.

DHW storage tank
During solar charging, preference is given to the DHW storage tank. At every level A, B or C (see below), it is charged with priority. Only then will the other consumers of the same level be charged. As soon as all setpoints of a level are attained, those of the next level are approached, whereby priority is again given to the DHW storage tank.

Buffer storage tank
During solar charging, preference is given to the buffer storage tank. At every level A, B or C (see below), it is charged with priority. Only then will the other consumers of the same level be charged. As soon as all setpoints of a level are attained, those of the next level are approached, whereby priority is again given to the buffer storage tank.

Storage tank setpoints:

Level	**DHW storage tank**		**Buffer storage tank**	
A	1610	Nominal setpoint	Setpoint (drag indicator)	
B	5050	Charging temp max	4750	Charging temp max
C	5051	Storage tank temp max	4751	Storage tank temp max

Charging time relative prio

If the preferred storage tank cannot be charged in accordance with charging control, priority is transferred to the next storage tank for the period of time set (e.g. temperature differential between collector and storage tank too great).

As soon as the preferred storage tank (according to setting "Charging prio storage tank") is again ready to be charged, the transfer of priority will immediately be stopped.

If the parameter is deactivated (---), priority always follows the settings "Charging priority storage tank".

Waiting time relative prio

During the period of time set, the transfer of priority is delayed. This prevents relative priority from intervening too often.

Waiting time parallel op

If solar output is sufficient and solar charging pumps are used, parallel operation is possible. In that case, the storage tank of the priority model can be the next to be charged at the same time, in addition to the storage tank to be charged next. Parallel operation can be delayed by introducing a waiting time. This way, in the case of parallel operation, switching on of the storage tanks can be effected in steps.
Setting (---) disables parallel operation.

Delay secondary pump

Commissioning of secondary pump for the external heat exchanger can be delayed. This prevents heat loss through any cold water still in the primary circuit.

6.6.3 Collector start function

Line no.	*Operating line*
3830	**Collector start function**
3831	**Min run time collector pump**
3832	**Collector start function on**
3833	**Collector start function off**
3834	**Collector start funct grad**

If the temperature at the collector (especially in the case of vacuum tubes) cannot be correctly acquired when the pump is deactivated, the pump can be activated from time to time.

Collector start function

This setting defines the interval at which the collector pump is put into operation. Then, the pump will operate for the set time "Min run time collector pump" (3831).

Collector start function on

This defines the time of day from which the collector start function is enabled.

Collector start function off

This defines the time of day from which the collector start function is deactivated (e.g. during the night).

Collector start funct grad

The collector pump is switched on as soon as the temperature rise on the collector sensor achieves the set gradient.

6.6.4 Collector frost protection

Line no.	*Operating line*
3840	**Collector frost protection**

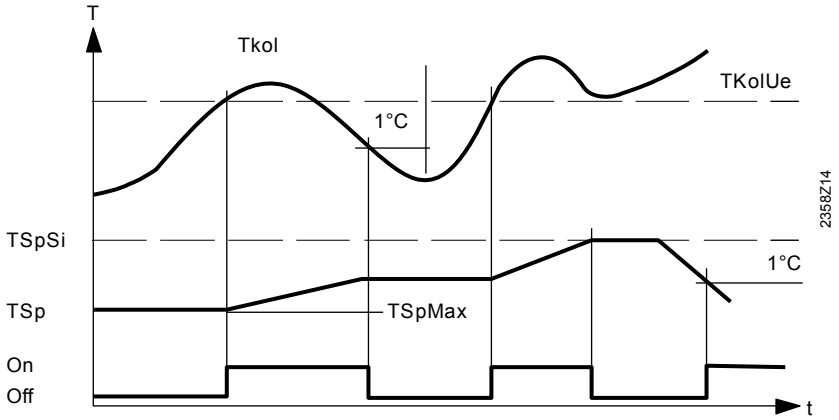
When there is risk of frost at the collector, the collector pump is activated to prevent the heat-carrying medium from freezing.

- If the collector temperature falls below the frost protection temperature, the collector pump is activated: TKol < TKolFrost.
- When the collector temperature returns to a level of 1 K above the frost protection temperature, the collector pump is deactivated again: TKol > TKolFrost + 1.

6.6.5 Collector overtemp prot

Line no.	*Operating line*
3850	**Collector overtemp prot**

If there is a risk of overtemperature at the collector, storage tank charging is continued to reduce the amount of excess heat. Charging stops when the storage tank's safety temperature is reached.



TSpSi	Storage tank safety temperature
TSp	Storage tank temperature
TKolUe	Collector temperature for overtemperature protection
TSpmax	Maximum charging temperature
Tkol	Collector temp
On / Off	Collector pump
T	temperature
t	Time

6.6.6 Medium's evaporation temperature

Line no.	*Operating line*
3860	**Evaporation heat carrier**

If there is a risk of the heat carrying medium evaporating due to high collector temperatures, the collector pump will be deactivated to prevent it from exceeding certain temperature levels. This is a protective pump function.

6.6.7 Speed control

Line no.	*Operating line*
3870	**Pump speed min**
3871	**Pump speed max**
3872	**Speed Xp**
3873	**Speed Tn**

Pump speed min / max

The solar pump motor speed is limited by a minimum and maximum permitted speed.

Speed P-band Xp and integral action time Tn

The charging setpoint of the storage tank with first-priority charging and the collector temperature are used for speed control. A PI controller calculates the speed required to ensure that the collector temperature is 2 K below the switch-on temperature.

If the collector temperature rises due to increased solar radiation, the speed is increased. If the collector temperature drops below this setpoint, the speed is reduced.

Limit parameters can be set to define a maximum and minimum pump speed (operating lines 3870 and 3871).

The PI controller can be influenced by parameters Xp and Tn. The controller has a dead band of +/- 1 K.

If the charging priority is changed, the controller regulates the speed in accordance with the new charging setpoint.

6.6.8 Yield measurement

Line no.	*Operating line*
3880	**Antifreeze**
3881	**Antifreeze concentration**
3884	**Pump capacity**
3887	**Pulse unit yield** None kWh Liters
3888	**Pulse value yield numer**
3889	**Pulse value yield denom**

The 24-hour and total solar energy yield (8526 and 8527) is calculated, based on these data.

Antifreeze

Since the mixing ratio of the collector medium has an impact on heat transmission, the type of antifreeze used and its concentration must be entered in order to be able to determine the energy yield.

Temperature differential measurement

Two additional sensors can be configured (Solar flow sensor B63, Solar return sensor B64). Collector sensor B6 is used if B63 is unavailable; the applicable storage tank sensor B31/B41 is used if B64 is unavailable.

Pump capacity

Pump capacity for the corresponding pump must be entered if there is no pulse measurement.
The yield measurement then uses this volumetric flow (l/h) for the calculation.

Pulse measurement

Each pulse received can be interpreted as a value (kWh or liters).
The pulse value is defined using settings 3887-3889 (unit, counter and denominator).

Examples

1 pulse value corresponds to $\frac{Counter}{Denom.} * unit = \frac{OL3888}{OL3889} * OL3887$

In other words, for example $\frac{1}{10} * kWh$ or $\frac{11}{2} * liter$

Input H1 programmed to a fixed "pulse measurement" is used.
The sum of the counted pulses is displayed in the pulse counter (OL 7842).

Pulse unit yield

None
The pulse value is not assigned a unit.

kWh
The pulse value is interpreted as kWh and added to operating line 8526 "24-hour yield solar energy".

Litres
The pulse value is counted as litres. The yield in kWh is determined based on the volumetric flow and temperature differential between collector flow and return and then added to operating line 8526 "24-hour yield solar energy".

Pulse value yield counter / pulse value yield dominator

The calculation model is compared to the applied pulse counter using the settings counter and denominator.

6.6.9 Readjustment

Line no.	*Operating line*
3896	**Readj solar flow sensor**
3897	**Readj solar return sensor**

Readjustment corrects imprecision to the sensor measured values.

6.7 Solid fuel boiler

6.7.1 Setpoints

Line no.	*Operating line*
4110	**Setpoint min**

Setpoint min

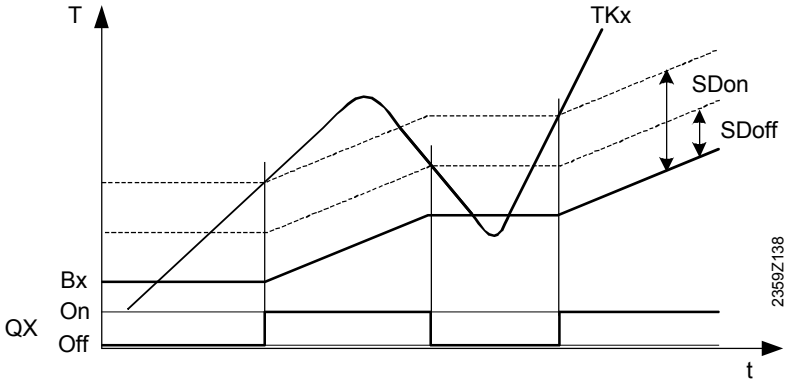
The boiler pump will be put into operation only when the boiler temperature has reached a minimum temperature level, in addition to the required temperature differential.

6.7.2 Boiler / burner control

Line no.	*Operating line*
4130	**Temp diff on**
4131	**Temp diff off**
4133	**Comparative temp** DHW sensor B31 Buffer storage tank sensor B4 Buffer storage tank sensor B41 Flow temperature setpoint Setpoint min

Delta T-controller

For the boiler pump to be put into operation, a sufficiently great temperature differential between boiler temperature and comparative temperature is required.



TKx	Boiler temperature
Bx	Actual comparative temperature
On / Off	Boiler pump
SDon	Temp diff on
SDoff	Temperature differential solar OFF

6.7.3 Overtemperature protection

Line no.	*Operating line*
4140	**Pump overrun time**

Pump overrun time

If the boiler temperature drops below the minimum temperature differential or the minimum setpoint, the boiler pump keeps running for the parameterized overrun time.

6.8 Buffer sensor

6.8.1 Operation

Line no.	*Operating line*
4700	**Nominal setpoint**
4701	**Release** 24 h/day Time program

Nominal setpoint

The nominal setpoint is used for buffer storage tank recharge using external generation. The multifunctional relay ZX1 must be defined as "Heat request K27".

The relay is enabled if the buffer storage tank temperature is below the nominal setpoints and the release (OL4701) allows this.

The buffer storage tank is not charged in summer for active summer/winter changeover (OL730).

The nominal setpoint has not impact on collectors and solid fuel boilers. These heat the buffer storage tank to the maximum charging temperature (OL4750). An active overheat protection function for the collector or boiler can exceed this value.

Release

24 h/day
The buffer storage tank recharge may always be released.

Time program
The buffer storage tank recharge may only be released, if
The time switch project (501-506) is set to "On". No heat demand is report during the remaining time.

6.8.2 Automatic locks

Line no.	*Operating line*
4720	**Auto generation lock** None With B4 With B4 and B41
4721	**Auto heat gen lock SD**

Auto generation lock

Under an automatic generation lock, controllable heat generation (via K27)= is only reactivated if the buffer storage tank is no longer able to cover present heat demand.

The automatic generation lock only act on configured relay "Heat request K27".

None
Function is deactivated.

With B4:
Sensor B4 is used releasing and locking the heat source.

With B4 and B41:
Sensor B4 is used for releasing the heat source. Sensor B41 is used generation lock.

Auto heat gen lock SD

The switching differential for generation lock can be set.

6.8.3 Overtemperature protection

Line no.	*Operating line*
4750	**Charging temp max**
4751	**Storage tank temp max**

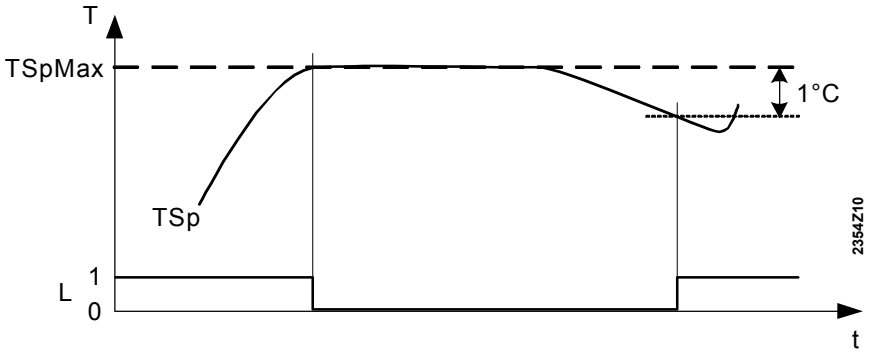
Charging temp max

The buffer storage tank is charged by the collectors and solid fuel boilers to the set "Charging temperature maximum".

The protective collector overtemperature function can reactivate the collector pump until "Storage tank temperature maximum" is reached.

Storage tank temp max

If the storage tank reaches the maximum storage tank temperature set here, the collector pump is deactivated. It will be released again when the storage tank temperature has dropped 1 °C below the maximum.



TSpMax Storage tank temp max (5051)
TSp Actual value of the storage tank temperature
L Storage tank charging: 1 = on, 0 = off

6.8.4 Recooling

Line no.	*Operating line*
4755	**Recooling temp**
4757	**Recooling collector** Off Summer Always

Recooling temp

If the buffer storage tank had to be charged via "Charging temp max", recooling to the recooling temperature set here takes place as soon as possible.

The function "Recooling collector" cannot be switched off for recooling.

Recooling collector

When the collector is cold, the energy can be emitted to the environment via the collector's surfaces.

6.8.5 Plant hydraulics

Line no.	*Operating line*
4783	**With solar integration**

Select here whether the buffer storage tank can be charged by solar energy.

6.8.6 Return diversion

Line no.	*Operating line*
4790	**Temp diff on return div**
4791	**Temp diff off return div**
4795	**Compar temp return div** B4 ¦ B41
4796	**Optg action return diversion** Temperature setback Temperature boost

At the corresponding temperature differential between the common return sensor B73 and the selectable comparative temperature, the return is divered through the lower part of the buffer storage tank. This function can be used to either **raise or lower the return temperature**. It is defined in OL 4796.

In addition, set the corresponding relay output as "Buffer return valve Y15" in the configuration relay output ZX1 (OL 5890) and the common return sensor B73 to BX1, 2 or 3 (5930, 5931, 5932).

Temp diff ON / OFF return diversion

The set temperature differential determines the switch on/off point for return diversion.

Comparative temperature return diversion

Select the buffer storage tank sensor for comparison with the return temperature to switch return diversion based on the set temperature differential.

Operation action of return diversion

Reduce temperature
If the return temperature from the consumers is higher than the temperature at the selected sensor (OL 4795), the return can be used to preheat the lower part of the storage tank. As a result, the return temperature continues to drop which, in the case of a condensing boiler, leads to higher efficiency.

Temperature increase
If the return temperature from the consumers is lower than the temperature at the selected sensor (OL 4795), the return can be preheated by diverting it via the lower part of the storage tank. It is thus possible to preheat the return, for example.

6.8.7 Transfer

Line no.	Operating line
4860	**Min buffer transfer temp**

Minimum buffer transfer temperature

The buffer storage tank can charge DHW storage tank.
The setting is required if the collectors / solid fuel boiler is not connected to the DHW storage tank, or if the connected collectors / solid fuel boiler does not supply sufficient energy.

The transfer occurs if the transfer temperature set here and the required transfer boost (5021) is reached.

6.9 DHW storage tank

6.9.1 Charging control

Line no.	Operating line
5021	**Transfer boost**

Transfer boost

Heat transfer makes it possible to transport energy from the buffer storage tank to the DHW storage tank. In that case, the actual buffer storage tank temperature must be higher than the actual temperature of the DHW storage tank.
The temperature differential can be set here.

6.9.2 Switching differential

Line no.	Operating line
5024	**Switching diff**

Switching differential

If the DHW temperature is lower than the current setpoint minus the switching differential set here, DHW charging is started.

DHW charging is completed when the temperature reaches the current setpoint.

When DHW heating is released for the first time in a 24-hour period, forced charging is initiated. DHW charging is also started when the DHW temperature lies within the switching differential, provided it does not lie less than K below the setpoint.

6.9.3 Charging time limitation

Line no.	Operating line
5030	**Charging time limitation**

Charging time limitation

The buffer storage tank may receive no or too little energy during DHW charging – regardless of the hydraulic circuit. For this reason, it is often practical to set a time limit to DHW charging.

- - -
Charging time limitation is deactivated. The DHW is heated up to the nominal setpoint, even if the buffer storage tank cannot draw sufficient heat for a certain period of time.

10 – 600
DHW charging is stopped after the set period of time in minutes and then locked for the same time before it is resumed. During this period of time, the heat produced is provided to buffer tank storage. This cycle is repeated until the nominal DHW setpoint is reached.

The charging time limitation has no effect if no buffer storage tank is available. There is no charging time limitation if the buffer storage tank is not used to heat the building.

6.9.4 Overtemperature protection

Line no.	*Operating line*
5050	**Charging temp max**

Charging temp max

The solar energy charges the DHW storage tank until the set maximum charging temperature.

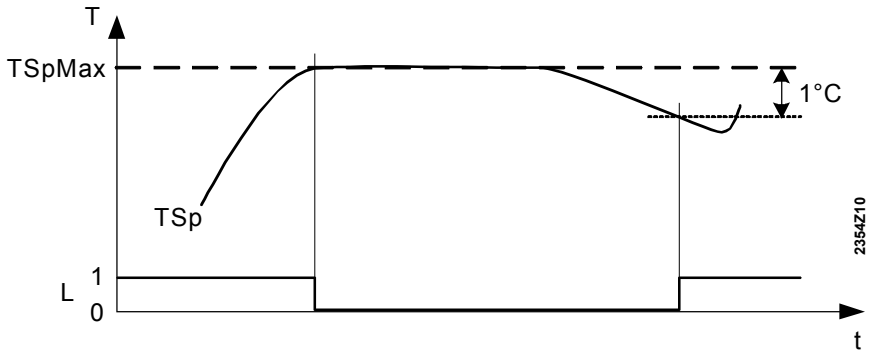
The "Protective collector overtemperature" function can reactivate the collector pump until the maximum swimming pool temperature is reached.

Line no.	*Operating line*
5051	**Storage tank temp max**

Storage tank temp max

Charging is aborted if the storage tank reaches the maximum storage tank temperature set here. It will be released again when the storage tank temperature has dropped 1 °C below the maximum.

The protective collector overtemperature function can reactivate the collector pump until the storage tank's safety temperature is reached.



TSpMax Storage tank temp max (5051)
TSp Actual value of the storage tank temperature
L Storage tank charging: 1 = on, 0 = off

6.9.5 Recooling

Line no.	*Operating line*
5055	**Recooling temp**
5057	**Recooling collector** Off Summer Always

Recooling temp

An activated recooling function remains in operation until the set recooling temperature in the DHW storage tank is reached.

Recooling collector

When the collector is cold, the energy can be emitted to the environment via the collector's surfaces.

6.9.6 Electric immersion heater

Line no.	*Operating line*
5060	**El imm heater optg mode** Summer Always
5061	**El immersion heater release** 24h / day Time program
5062	**El immersion heater control** External thermostat DHW sensor

El imm heater optg mode

Summer
The electric immersion heating is enabled if the controller changes over to summer mode. The temperature measured at night on the collector must exceed "Summer / winter heating limit" (730).

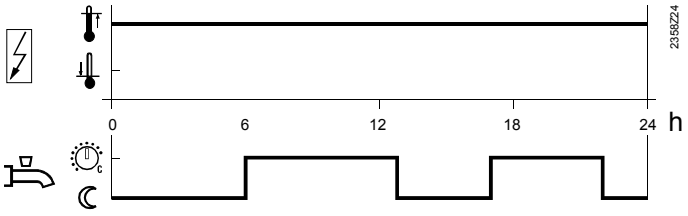
Always
DHW is heated or recharged with the electric immersion heater throughout the year.

Premature DHW charging makes it impossible for collectors and solid fuel boiler to charge.

El immersion heater release

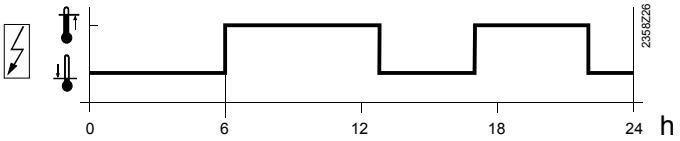
24h / day
The electric immersion heater is always released, independent of time programs and DHW release.

Example:



Time program
For the electric immersion heater, the time program for the controller is taken into account.

Example:



Actual release takes place only if the electric immersion heater can operate according to setting "El imm heater optg mode" (5060).

El immersion heater control

External thermostat
The DHW storage tank is charged with an external thermostat without setpoint compensation by the controller.

DHW sensor
The DHW storage tank is charged with an electric immersion heater, with setpoint compensation by the controller.

To ensure that setpoint compensation operates as required, the external thermostat must be set to the minimum storage temperature.

6.9.7 DHW push

Line no.	*Operating line*
5070	**Automatic push** Off On.

Automatic push

The DHW push can be automatically triggered.
With the DHW push, the DHW is heated up once until the nominal setpoint is reached.

Off
DHW push is switched off.

On
If the DHW temperature falls by more than 2 switching differentials (5024) below the reduced setpoint (1612), one-time charging to the nominal DHW setpoint (1610) will take place again.

The solid fuel boiler or collectors conduct the automatic push if they supply sufficient energy. Otherwise, the electric immersion heater or an external generator (via heat request K27) can be used.

6.9.8 Plant hydraulics

Line no.	*Operating line*
5093	**With solar integration**

With solar integration

Set whether the DHW storage tank receives its heat from the solar collectors.

6.9.9 Transfer

Line no.	*Operating line*
5130	**Transfer strategy** Always ¦ DHW release

Transfer strategy

Transfer is permitted either always or at the release times set (1620).

6.10 Configuration

6.10.1 Procedure

First, make use of the presetting choices and enter the plant diagram that comes closest to the plant in question. Then, modify manually the individual partial diagrams to match them to the actual requirements.

After that, select the extra functions and make the fine-tuning via the operating lines of the individual parameters.

6.10.2 Preselection of plant diagram

Line no.	*Operating line*
5700	**Presetting** --- ¦ 1-5

Preselection

Five presettings are available for various types of storage tank management.

The sensors contained in the desired plant diagram (see pg. 52 et seq.) must be connected prior to setting.

Presetting number	Description	Required sensors / pumps
1	DHW or buffer storage tank charge	B6 / Q5 / B31 or B41
2	DHW or buffer storage tank charge with external heat exchanger	B6 / Q5 / B31 or B41 / K9
3	DHW and buffer storage tank charge with charging pump	B6 / Q5 / B31 and B41 / K8
4	DHW and buffer storage tank charge with diverting valve	B6 / Q5 / B31 and B41 / K8
5	DHW or buffer storage tank charge with 2 collector fields	B6 / Q5 / B31 or B41 / Q16 / B61

Selecting presetting for the desired plant diagram (basic diagrams 1-5) defines the settings required fort he multifunctional output ZX1 and the multifunctional sensor inputs BX1-3 as well as for the solar control elements as follows:

Presetting number		1	2	3	4	5
OL 5840	Solar controlling element	Charging pump	Charging pump	Charging pump	Diverting valve	Charging pump
OL 5890	Relay output ZX1	- - -	K9	K8	K8	Q16
OL 5930	Sensor input BX1	B31	B31	B31	B31	B31
OL 5931	Sensor input BX2	B41	B41	B41	B41	B41
OL 5932	Sensor input BX3	- - -	- - -	- - -	- - -	B61

OL = Operating line

6.10.3 Manual selection / Adaption of partial diagrams

A plant diagram consists of several partial diagrams.

It is possible to manually compose the required plant diagram from the respective partial diagrams.

But it is also possible to modify and adjust partial diagrams of a plant diagram generated via "Presetting" (5700).

The partial diagrams in the controller are listed in Section "Applications" (see page 52 et. seq.). Also listed in the catalogue are the required operating lines which must be set to produce the respective partial diagrams, plus the sensors required for the relevant partial diagram.

6.10.4 Solar

Line no.	*Operating line*
5840	**Solar controlling element** Charging pump Diverting valve

Solar controlling element

The solar plant storage tank can either be integrated using a diverting valve (with a collector pump) over via a separate charging pump.

When using a diverting valve, it is always only one heat exchanger that can be used at a time. Only alternative operation is possible.

When using charging pumps, all heat exchangers can be used at the same time. Either parallel or alternative operation is possible.

6.10.5 Multifunctional output ZX1

Line no.	*Operating line*
5890	**Relay output ZX1** None Circulating pump Q4 Collector pump 2 Q16 Solar controlling element buffer K8 Solar pump external exchanger K9 Alarm output K10 Storage tank transfer pump Q11 Buffer return valve Y15 Solid fuel boiler pump Q10 Electric immersion heater DHW K6 Heat request K27 Overtemperature protection K11

Depending on the selection made, setting of the relay outputs assigns appropriate extra functions to the basic diagrams. See the Section "Applications".

DHW circulating pump Q4
The connected pump serves as a DHW circulating pump.
Operation of the pump can be scheduled as required on operating page "DHW", operating line "Release circulating pump".

Collector pump 2 Q16
When using a solar collector, a circulating pump for the collector circuit is required.

Solar controlling element buffer K8
If several heat exchangers are used, the buffer storage tank must be set at the respective relay output and, in addition, the type of solar controlling element must be defined on OL 5840).

Solar pump external exchanger K9
For the external heat exchanger, solar pump "Ext heat exchanger K9" must be set at the multifunctional relay output (ZX1).

Alarm output K10
The alarm relay signals faults, should they occur.
Switching on takes place with a delay of 2 minutes.
When the fault is corrected, that is, when the error message is no longer present, the contact opens with no delay.

If the fault cannot immediately be corrected, it is still possible to reset the alarm relay. This is made on operating page "Faults".

Storage tank transfer pump Q11
If the temperature level of the buffer storage tank is high enough, the DHW storage tank can be charged by the buffer. This transfer can be made by means of transfer pump Q11.

Buffer return valve Y15
The valve must be configured for return temperature increase / decrease or buffer storage tank partial charging.

Solid fuel boiler pump Q10
For the connection of a solid fuel boiler, a circulating pump for the boiler circuit is required.

DHW electric immersion heater K6
Using the connected electric immersion heater, the DHW can be heated up according to operating page "DHW storage tank", operating line "Electric immersion heater".

The electric immersion heater must be fitted with a safety limit thermostat!

Operating line 5060 of the electric immersion heater’s operating mode must be appropriately set.

Heat request K27
Output K27 is enabled as soon as there is a heat request.

Overtemperature protection K11
Output K11 is enabled when the tempature reaches the set overheat protection temperature (6209) on the defined reference sensor (OL6208).
It remains enabled until the temperature drops below the overheat protection temperature by the set switching differential (6210).

6.10.6 Input sensor BX1-3

Line no.	*Operating line*
5930,5931, 5932	**Sensor input BX1, 2, 3** None DHW sensor B3 DHW sensor B31 Buffer storage tank sensor B4 Buffer storage tank sensor B41 Collector sensor 2 B61 Solar flow sensor B63 Solar return sensor B64 Common return sensor B73 Solid fuel boiler sensor B22 DHW circulation sensor B39

Depending on the selection made, setting of the sensor inputs assigns appropriate extra functions to the basic diagrams. See Section "Auxiliary functions".

6.10.7 PWM output P1

Line no.	*Operating line*
6085	**Function output P1** None Per output Q5 Per output ZX1

Function output P1

Output P1 makes possible the control of variable speed pumps with a pulse-width-modulated low voltage signal.

The relay terminal connections of the relevant pump in that case do not change; they will only be complemented by the PWM control line.

The corresponding TRIAC output for the pump is switched ON/OFF, but not modulated.

None
Output P1 is not controlled.

Per output Q5
The low voltage signal is calculated and issued for collector pump Q5.

Per output ZX1
The low voltage signal is calculated and issed for the pump connected to relay output ZX1 (Q4, Q16, K9, Q11 or Q10).

6.10.8 Types of sensor / readjustment

Line no.	*Operating line*
6097	**Sensor type collector** NTC Pt 1000
6098	**Readjustm collector sensor**
6099	**Readjustm coll sensor 2**

Sensor type collector

Setting of the sensor type for collector sensor 1 and 2. The control applies the corresponding temperature characteristic curve (see Section "Sensor characteristics").

Readjustm collector sensor

The measured value can be corrected.

6.10.9 Sensor state

Line no.	*Operating line*
6200	**Save sensors**

At midnight, the basic unit stores the states at the sensor terminals.
If, after storage, a sensor fails, the basic unit generates an error message.

This setting is used to ensure immediate saving of the sensors. This is necessary when, for instance, a sensor is removed because it is no longer needed.

6.10.10 Save parameters

Line no.	*Operating line*
6204	**Save parameters**

.

The current parameter settings can be saved as new default settings. Exempted from this are the following menus: Time of day and date, operator section, wireless, and all time programs, as well as the number of operating hours and the different counters.

⚠

Important:
With this process, the factory settings will be overwritten and cannot be retrieved!

6.10.11 Parameter reset

Line no.	*Operating line*
6205	**Reset to default parameters**

The parameters can be reset to their default values. Exempted from this are the following menus: Time and date, schedule as well as operating house and the various counters.

6.10.12 Heat request

Line no.	*Operating line*
6207	**Heat request K27**

A heat request can be output to an external, controllable heat generator via relay ZX1. The setting defines the situations when heat request is output.

Domestic hot water
Heat request is output if a temperature demand is pending for DHW storage tank.

Buffer sensor
Heat request is output if a temperature demand is pending for buffer storage tank.

6.10.13 Overtemperature protection

Line no.	*Operating line*
6208	**Excess heat dischar sensor**
6209	**Excess heat discharge temp**
6210	**Swi diff excess heat disch**

Overtemperature protection

Define the sensor used to monitor overtemperature protection.

B3	In the DHW storage tank with comparative temperature B3
B31	In the DHW storage tank with comparative temperature B31
B4	In the buffer storage tank with comparative temperature B4
B41	In the buffer storage tank with comparative temperature B41
B22	In the solid fuel boiler
B6	Vir collectors to the environment

Overtemperature protection

Limit value for the overtemperature protection function. It is considered overtemperature if the measured temperature is above this value and overtemperature protection is started.

Overtemperature protection SD

The overtemperature protection stops as soon as the measured temperature is below the "overtemperature protection" (6209) by the switching differential as set here.

6.10.14 Device data

Line no.	*Operating line*
6220	**Software version**
6222	**Device hours run**

Software version

The software version indicated here represents the current controller version.

Device hours run

This indicates the total number of operating hours since the controller was first commissioned.

6.11 Fault

If a fault is pending, the associated error message on the information level can be queried via the info button or the error history on OL 6800-6808. The display describes the cause of the error.

Pending errors are assigned priorities. As of priority < 6 any configured alarm output K10 (OL 5890) is enabled.

Code	Text	Description of error	Prio
25	25:Boiler sensor solid fuel	Solid fuel boiler temperature (wood) sensor error	6
47	47:Common return sensor	Common return temperature sensor error	6
50	50:DHW sensor 1	DHW temperature 1 sensor error	6
52	52:DHW sensor 2	DHW temperature 2 sensor error	6
57	57:DHW circulation sensor	DHW circulation temperature sensor error	6
70	70:Storage tank sensor 1	Buffer storage tank temperature 1 sensor error	6
71	71:Storage tank sensor 2	Buffer storage tank temperature 2 sensor error	6
73	73:Collector sensor 1	Collector temperature 1 sensor error	6
74	74:Collector sensor 2	Collector temperature 2 sensor error	6
126	126:DHW charg temp	DHW - loading supervision	6
127	127:Legionella temp	Legionella temperature not reached	6
201	201:Frost alarm	Frost alarm	9
241	241:Flow sensor yield	Flow sensor, solar sensor error	6
242	242:Return sensor yield	Return sensor, solar sensor error	6
324	324:BX same sensors	BX same sensors	3
330	330:BX1 no function	Sensor BX1 no function	3
331	331:BX2 no function	Sensor BX2 no function	3
332	332:BX3 no function	Sensor BX3 no function	3
339	339:Coll pump Q5 missing	Collector pump Q5 missing	3
340	340:Coll pump Q16 missing	Collector pump Q16 missing	3
341	341:Coll sensor B6 missing	Collector sensor B6 missing	3
342	342:Solar DHW B31missing	Solar DHW sensor B31 missing	3
343	343:Solar integration missing	Solar integration missing	3
344	344:Solar buffer K8 missing	Solar controlling element buffer K8 missing	3
346	346:Boiler pump Q10 missing	Solid fuel boiler pump Q10 missing	3
347	347:Solid fuel boil comp sens	Solid fuel boiler comparison sensor missing	3
349	349:Buff valve Y15 missing	Buffer return valve Y15 missing	3

Acknowledgements

Line no.	*Operating line*
6710	**Reset alarm relay** No Yes

When a fault is pending, an alarm can be triggered on relay ZX1. Relay ZX1 must be configured accordingly.
This setting is used to reset the relay, but the alarm is maintained.

Error history

Line no.	*Operating line*
6800…6808	**Time stamp and error history 1 - 5**

The basic unit stores the last 5 faults in non-volatile memory. Any additional entry deletes the oldest in the memory. For each error entry, error code and time of occurrence are saved.

Possible error messages are listed in Section "List of displays".

Reset history

Line no.	*Operating line*
6820	**Reset history** No Yes

The error history with the last 5 errors, the associated actual values and setpoints and the relay output states will be deleted.

6.12 Input/output test

Relay test

Line no.	*Operating line*
7705	**Mod setpoint Q5 relay test**
7708	**Modulation signal Q5 test**
7711	**Mod setpoint ZX1 relay test**
7712	**Modulation signal ZX1 test**

The input / output test checks for proper operation and correct wiring of the connected components.

Relay test Q5/ZX1

A signal from 0-100% can be output on the corresponding output.
The value in % corresponds to the desired water volume.

Modulation signal Q5/ZX1

View of present modulation signal on output Q5 or ZX1

Sensor test

Line no.	*Operating line*
7750	**Collector temp B6**
7820	**Sensor temp BX1**
7821	**Sensor temp BX2**
7822	**Sensor temp BX3**

Select a sensor test to display the corresponding input and check it in this manner.

The selected sensor values are updated within a maximum of 5 seconds.
The display is made with no measured value correction.

Pulse counter

Line no.	*Operating line*
7842	**Pulse counter H1**

Display of the sum total of pulses on input H1 since the pulse counter was comissioned. (Input H1 is set programmed for pulse counting and is not used by another function).

6.13 State of plant

The current operating state of the plant is visualized by means of status displays. Status messages can be queried with the info button or via OL 8003-8010.

Status messages

Line no.	*Operating line*
8003	**State DHW**
8007	**State solar**
8008	**State solid fuel boiler**
8010	**State buffer**

State DHW

End user (info level)	Commissioning, heating engineer	
Consumption	Consumption	199
	Recooling via collector	77
	Recooling via heat gen/HCs	78
Recooling active		53
	Discharging prot active	79
	Charg time limitation active	80
	Charging locked	81
Charging lock active		82
	Forced, max st tank temp	83
	Forced, max charging temp	84
	Forced, legionella setp	85
	Forced, nominal setp	86
Forced charging active		67
	El charging, legionella setp	87
	El charging, nominal setp	88
	El charging, reduced setp	89
	El charging, frost prot setp	90
	El imm heater released	91
Charg el imm heater		66
	Push, legionella setp	92
	Push, nominal setp	93
Push active		94
	Charging, legionella setp	95
	Charging, nominal setp	96
	Charging, reduced setp	97
Charging active		69
Frost protection active	Frost protection active	24
Overrun active	Overrun active	17
Standby charging	Standby charging	201
	Charged, max st tank temp	70
	Charged, max charging temp	71
	Charged, legionella temp	98
	Charged, nominal temp	99
	Charged, reduced temp	100
Charged		75
Off	Off	25
Ready	Ready	200

State solar

End user (info level)	*Commissioning, heating engineer*	
Fault	Fault	2
Frost prot collector active	Frost prot collector active	52
Recooling active	Recooling active	53
Max st tank temp reached	Max st tank temp reached	54
Evaporation prot active	Evaporation prot active	55
Overtemp prot active	Overtemp prot active	56
Max charging temp reached	Max charging temp reached	57
Charging DHW+buffer	Charging DHW+buffer	152
Charging DHW	Charging DHW	58
Charging buffer	Charging buffer	59
Radiation insufficient	Radiation insufficient	63

State solid fuel boiler

End user (info level)	*Commissioning, heating engineer*	
Fault	Fault	2
Overtemp prot active	Overtemp prot active	56
	Locked, manual	8
	Locked, automatic	9
Locked		10
	Min limitation	20
	Min limitation, low-fire	21
Min limitation active	Min limitation active	22
	Protective start	11
	Protective start, low-fire	12
	Return limitation	13
	Return limitation, low-fire	14
In operation for DHW	In operation for DHW	168
In part load op for DHW	In part load op for DHW	169
Overrun active	Overrun active	17
In operation	In operation	18
Released	Released	19
	Frost prot plant active	23
	Boiler frost prot active	141
Frost protection active		24
Off	Off	25

State buffer

End user (info level)	*Commissioning, heating engineer*	
	Locking time after heating	135
	Charging locked	81
Charging restricted		124
	Forced charging active	67
	Full charging active	203
Charging active		69
	Charged, forced temp	72
	Charged, required temp	73
	Charged, min charging temp	143
Charged		75
Hot	Hot	147
No request	No request	51
Frost protection active	Frost protection active	24
	El charg, emergency mode	64
	Electric charging, forced	164
	Electric charging, substitute	165
Charg el imm heater		66
	Charging locked	81
	Restricted, DHW priority	104
Charging restricted		124
	Forced charging active	67
	Partial charging active	68
Charging active	Charging active	69
	Recooling via collector	77
	Recooling via DHW/HCs	142
Recooling active		53
	Charged, max st tank temp	70
	Charged, max charging temp	71
	Charged, forced temp	72
	Charged, required temp	73
	Part charged, required temp	74
	Charged, min charging temp	143
Charged		75
Cold	Cold	76
No request	No request	51

6.14 Diagnostics heat source

6.14.1 Solar collectors

Various setpoints, actual values, relay switching states and meter readings can be displayed for diagnostics (see Overview of settings as of page 18).

Line no.	*Operating line*
8505…8570	

6.15 Diagnostics of consumer

6.15.1 DHW / Buffer storage tank

Various setpoints and actual values can be displayed for diagnostics (see Overview of settings as of page 18).

Line no.	*Operating line*
8703…8835	***DHW diagnostics***
8980…8982	***Buffer storage tank diagnostics***

7 Plant diagrams

The various applications are shown in the form of basic diagrams and auxiliary functions.

The basic diagrams are applications that operate without additional settings. Auxiliary functions extend the functionality of the basic diagram.

7.1 Basic diagrams

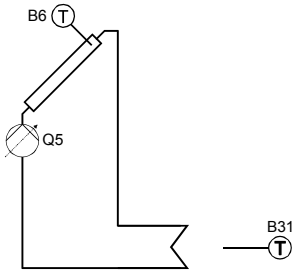
Predefined plant diagrams (basic diagrams) can be selected via OL 5700.

The selection of a basic diagram automatically defines the terminals required for operation and undertake the requisite operating line settings.

The controller automatically recognizes whether a DHW and / or buffer storage tank is connected based on connected temperature sensors B31 or B41.

OL=Operating line number

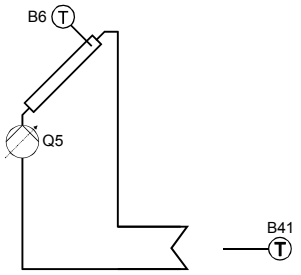
Presetting 1
DHW storage tank charge



Automatic settings:
B6:
– Collector sensor B6
OL 5930 BX1:
– DHW sensor B31
Q5:
– collector pump Q5

(OL 5840 Solar cntrl elem:)
(charging pump)

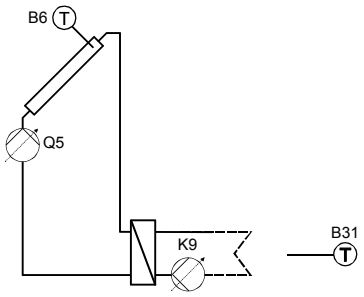
Buffer storage tank charging



Automatic settings:
B6:
– Collector sensor B6
OL 5931 BX2:
– Buffer storage tank sensor B41
Q5:
– collector pump Q5

(OL 5840 Solar cntrl elem:)
(charging pump)

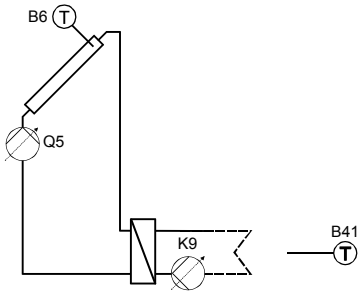
Presetting 2
DHW storage tank charging via external exchanger



Automatic settings:
B6:
– Collector sensor B6
OL 5930 BX1:
– DHW sensor B31
Q5:
– collector pump Q5
OL 5890 ZX1:
– Solar pump external exchanger K9

(OL 5840 Solar cntrl elem:)
(charging pump)

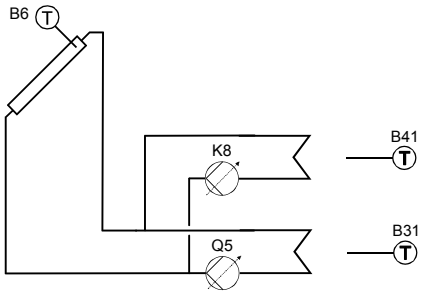
Buffer storage tank charging via external exchanger



Automatic settings:
B6:
– Collector sensor B6
OL 5931 BX2:
– Buffer storage tank sensor B41
Q5:
– collector pump Q5
OL 5890 ZX1:
– Solar pump external exchanger K9

(OL 5840 Solar cntrl elem:)
(charging pump)

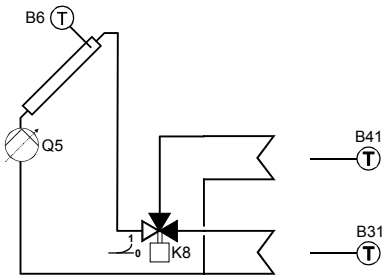
Presetting 3
DHW **and** buffer storage tank charge with charging pump.



Automatic settings:
B6:
– Collector sensor B6
OL 5930 BX1:
– DHW sensor B31
OL 5931 BX2:
– Buffer storage tank sensor B41
Q5:
– collector pump Q5
OL 5890 ZX1:
– Solar controlling element buffer K8

(OL 5840 Solar ctrl elem:)
– Charging pump

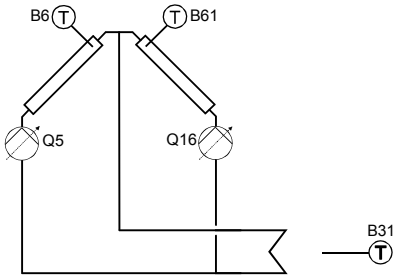
Presetting 4
DHW **and** buffer storage tank charge
with diverting valve.



Automatic settings:
B6:
– Collector sensor B6
OL 5930 BX1:
– DHW sensor B31
OL 5931 BX2:
– Buffer storage tank sensor B41
Q5:
– collector pump Q5
OL 5890 ZX1:
– Solar controlling element buffer K8

(OL 5840 Solar ctrl elem:)
– Diverting valve

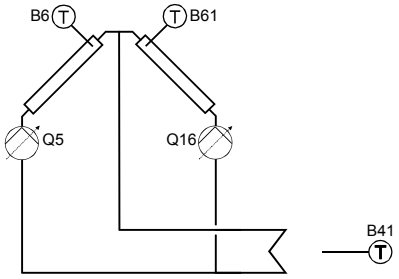
Presetting 5
DHW storage tank charge
with 2 collector fields



Automatic settings:
B6:
– Collector sensor B6
OL 5930 BX1:
– DHW sensor B31
OL 5932 BX3:
– Collector sensor B61
Q5:
– collector pump Q5
OL 5890 ZX1:
– Collector pump 2 Q16

(OL 5840 Solar cntrl elem:)
(charging pump)

Buffer storage tank charge
with 2 collector fields



Automatic settings:
B6:
– Collector sensor B6
OL 5931 BX2:
– Buffer storage tank sensor B41
OL 5932 BX3:
– Collector sensor B61
Q5:
– collector pump Q5
OL 5890 ZX1:
– Collector pump 2 Q16

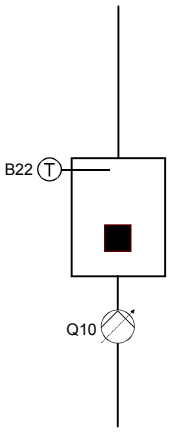
(OL 5840 Solar cntrl elem:)
(charging pump)

7.2 Auxiliary functions

Ooutput ZX1 is not used for basic diagram with presetting 1 and can be used for various auxiliary functions.
The auxiliary functions can be selected via operating lines in section "Configuration" and complement the basic diagrams of the controllers.

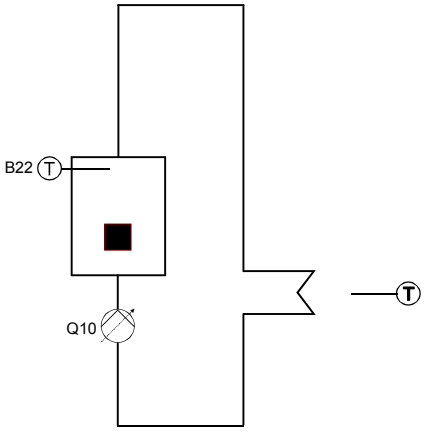
7.2.1 Heat generation (wood)

Ho1
Boiler pump control by temperature differential between B22 + ZN4133



Required settings:
OL 5890 ZX1:
– Solid fuel boiler pump Q10
OL 5930-5932 BX:
– Solid fuel boiler sensor B22
OL 4133
Comparative temperature:
– Flow setpoint or
– Setpoint min

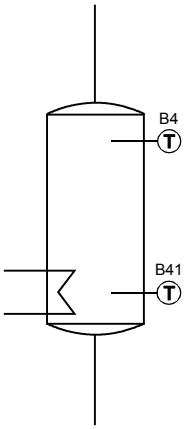
Ho2
Boiler pump control by temperature differential between B22 + storage tank



Required settings:
OL 5890 ZX1:
– Solid fuel boiler pump Q10
OL 5930-5932 BX:
– Solid fuel boiler sensor B22
OL 4133
Comparative temperature:
– DHW sensor B3 or
– DHW sensor B31 or
– Buffer storage tank sensor B4 or
– Buffer storage tank sensor B41

7.2.2 Buffer storage tank

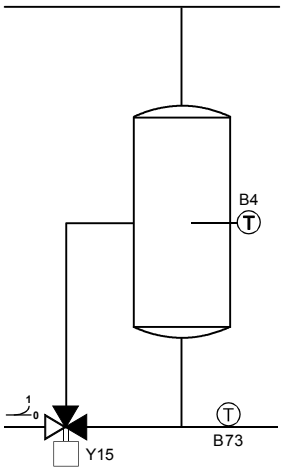
Sp2
External generation or solid fuel boiler



Required settings:
OL 5930/5932 BX:
– Buffer storage tank sensor B4

Optional settings:
for ext. generation
OL 5890 ZX1:
– Heat request K27
OL 6207
– For buffer storage tank
for solid fuel boiler
Operating line 4133
Comparative temp
Solid fuel boiler
– B4 or B41

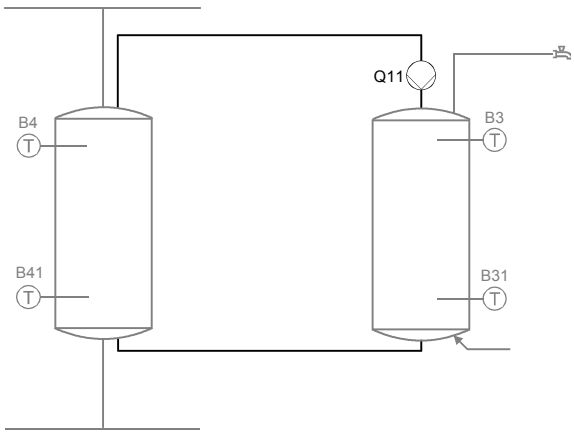
Return diverting valve



Required settings:
OL 5890 ZX1:
– Buffer return valve Y15
OL 5930/5932 BX:
– Common return sensor B73
OL 4795
Comparative temperature return diverting valve:
– B4

Optional settings:
ZN 4790 (EIN RLU).
ZN 4791 (OFF RLU).
ZN 4796 (operating action RLU)

Storage tank transfer pump

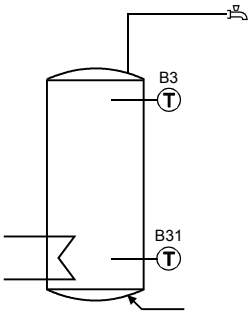


Required settings:
OL 5890 ZX1:
– Storage tank transfer pump Q11
OL 5131
Comparative temperature transfer:
– DHW sensor B3
– or B31

Optional settings:
OL 5130 (Heat transfer strategy).

7.2.3 DHW storage tank (DHW)

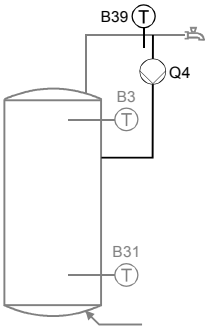
DHWSp2
External generation or solid fuel boiler



Required settings:
OL 5931-5932 BX:
– DHW sensor B3
ℹ DHW sensor B31 is already included in the basic diagram

Optional settings:
for ext. generation
OL 5890 ZX1:
– Heat request K27
OL 6207
– For DHW storage tank
for solid fuel boiler
Operating line 4133
Comparative temp
Solid fuel boiler
– B3 or B31

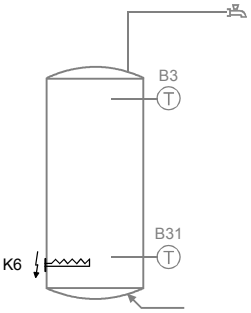
DHW circulating pump / circulation sensor



Required settings:
OL 5890 ZX1:
– Circulating pump Q4

Optional settings:
OL 1660 (release).
OL 1661 (cycling).
OL 1663 (circulation setpoint).
OL 5931-5932 BX:
– DHW circulation sensor B39

DHW storage tank electric immersion heater

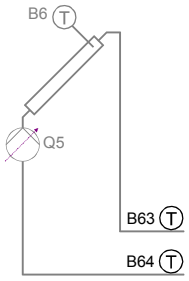


Required settings:
OL 5890 ZX1:
– Electric immersion heater DHW K6

Optional settings:
OL 5060 (operating mode).
OL 5061 (release).
OL 5062 (control).

7.2.4 Solar collectors

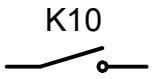
Temperature differential measurement



Required settings:
OL 5931-5932 BX:
- Solar flow sensor B63 (warm)
- Solar return sensor B64 (cold)

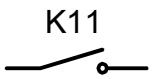
7.2.5 Signals

Alarm output



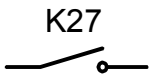
Required settings:
OL 5890 ZX1:
– alarm output K10

Overtemperature protection



Required settings:
OL 5890 ZX1:
– Overtemperature protection K11

Heat requisition



Required settings:
OL 5890 ZX1:
– Heat request K27

7.2.6 Legend mains voltage

Designation	*Function*
Q4	Circulating pump
Q5	Collector pump
Q10	Solid fuel boiler pump
Q11	Storage tank charging pump
Q16	Collector pump 2
Y15	Buffer return valve
K6	electric immersion heater
K8	Solar ctrl elem buffer (charing pump or diverting valve)
K9	Solar pump ext. heat exchanger
K10	Alarm output
K11	Overtemperature protection
K27	Heat requisition

7.2.7 Legend low-voltage

Designation	*Function*
B22	Soild fuel boiler sensor
B3	DHW sensor top
B31	2. DHW sensor bottom
B39	DHW circulation sensor
B4	Buffer storage tank temperature sensor
B41	Buffer storage tank temperature sensor
B6	Collector sensor
B61	Collector sensor 2
B63	Solar flow sensor B63
B64	Solar return sensor B63
B73	Common return sensor

8 Technical data

8.1 Basic units RVA78.690

Power supply	Rated voltage	AC 230 V (±10%)
	Rated frequency	50/60 Hz
	Max. power consumption	RVA78.690: 10 VA
	Fusing of supply lines	max. 10 AT
Wiring of terminals	Power supply and outputs	solid wire or stranded wire (twisted or with ferrule): 1 core: 0.5...2.5 mm^2 2 cores: 0.5. mm^2..1.5 mm^2 3 cores: not allowed.
Functional data	Software class	A
	Mode of operation to EN 60 730	1.B (automatic operation)
Inputs	Sensor inputs B6, BX1…BX3	NTC10k PT1000 (selectable for collector sensor)

Perm. sensor cables (copper)						
with cross-sectional area:	0.25	0.5	0.75	1.0	1.5	Mm^2
Max. length	20	40	60	80	120	M

Outputs	Triac outputs Q5, ZX1	
	Rated current range	
	ON/OFF mode (Zero crossing switched)	AC 0.05…1 (2) A
	Speed control	AC 0.05...0.8 (0.8) A
	Max. switch-on current	4 A for <1 second 30 A at <20 ms
	PWM output P1	
	Signal frequency	3 kHz
	Output voltage	V_{out_high} > + 4 V (with no load) V_{out_low} < +1 V
	degree of modulation	3 % ... 97 %
Degree of protection and safety class	Degree of protection of housing to EN 60 529	IP 00
	Safety class to EN 60 730	low-voltage-carrying parts meet the requirements of safety class II, if correctly installed
	Degree of pollution to EN 60 730	normal pollution
Standards, safety, EMC, etc.	CE conformity to	
	EMC directive	89/336/EEC
	- Immunity	- EN 61000-6-2
	- Emissions	- EN 61000-6-3
	Low-voltage directive	73/23/EEC
	- Electrical safety	- EN 60730-1, EN 60730-2-9
Climatic conditions	Storage to IEC721-3-1 class 1K3	temperature -20…65°C
	Transport to IEC721-3-2 class 2K3	temperature -25…70 °C
	Operation to IEC721-3-3 class 3K5	temperature 0...50 °C (noncondensing)
Weight	Without packaging	RVA78.690: 530 g

8.2 Sensor characteristics

8.2.1 NTC 10 k

T [°C]	R[Ohm]	T [°C]	R[Ohm]	T [°C]	R[Ohm]
-30.0	175203	50.0	3605	130.0	298
-25.0	129289	55.0	2989	135.0	262
-20.0	96360	60.0	2490	140.0	232
-15.0	72502	65.0	2084	145.0	206
-10.0	55047	70.0	1753	150.0	183
-5.0	42158	75.0	1481	155.0	163
0.0	32555	80.0	1256	160.0	145
5.0	25339	85.0	1070	165.0	130
10.0	19873	90.0	915	170.0	117
15.0	15699	95.0	786	175.0	105
20.0	12488	100.0	677	180.0	95
25.0	10000	105.0	586	185.0	85
30.0	8059	110.0	508	190.0	77
35.0	6535	115.0	443	195.0	70
40.0	5330	120.0	387	200.0	64
45.0	4372	125.0	339		

8.2.2 PT1000

T [°C]	R[Ohm]	T [°C]	R[Ohm]	T [°C]	R[Ohm]
-30.0	882.24	100.0	1,385.00	230.0	1,868.21
-25.0	901.94	105.0	1,403.95	235.0	1,886.40
-20.0	921.61	110.0	1,422.86	240.0	1,904.57
-15.0	941.25	115.0	1,441.75	245.0	1,922.70
-10.0	960.86	120.0	1,460.61	250.0	1,940.81
-5.0	980.45	125.0	1,479.44	255.0	1,958.89
0.0	1,000.00	130.0	1,498.24	260.0	1,976.94
5.0	1,019.52	135.0	1,517.02	265.0	1,994.96
10.0	1,039.02	140.0	1,535.76	270.0	2,012.95
15.0	1,058.49	145.0	1,554.48	275.0	2,030.91
20.0	1,077.93	150.0	1,573.16	280.0	2,048.85
25.0	1,097.33	155.0	1,591.82	285.0	2,066.75
30.0	1,116.71	160.0	1,610.45	290.0	2,084.63
35.0	1,136.07	165.0	1,629.05	295.0	2,102.48
40.0	1,155.39	170.0	1,647.62	300.0	2,120.30
45.0	1,174.68	175.0	1,666.16	305.0	2,138.08
50.0	1,193.95	180.0	1,684.67	310.0	2,155.85
55.0	1,213.18	185.0	1,703.15	315.0	2,173.58
60.0	1,232.39	190.0	1,721.61	320.0	2,191.28
65.0	1,251.57	195.0	1,740.03	325.0	2,208.95
70.0	1,270.71	200.0	1,758.43	330.0	2,226.60
75.0	1,289.83	205.0	1,776.80	335.0	2,244.21
80.0	1,308.93	210.0	1,795.14	340.0	2,261.80
85.0	1,327.99	215.0	1,813.45	345.0	2,279.36
90.0	1,347.02	220.0	1,831.73	350.0	2,296.89
95.0	1,366.02	225.0	1,849.98		

Index

Siemens Switzerland Ltd
Industry Sector
Building Technologies Division
Gubelstrasse 22
6301 Zug
Switzerland
Tel. +41 41-724 24 24
www.siemens.com/sbt