Heating circuit and solar controller

grandis 650 HK

Hydraulic layouts

English version of original German installation and operating instructions

Version: 1.4
August 2017

This manual is designed to help you use the controller properly, safely and economically.

Target group

This manual is addressed to all persons who carry out any of the following tasks:

- Installing the controller
- Connecting the controller
- Putting the controller into operation
- Setting the controller
- Maintaining the solar power system
- Eliminating faults on the controller and the solar power system
- Disposing of the controller

- These persons must have the following knowledge and skills:
- Knowledge about establishing electrical connections
- Knowledge about the hydraulic operation of solar power systems
- Knowledge of the applicable regulations at the point of use and the ability to apply them

These persons must have read and understood the contents of this manual.

Availability

This manual is part of the controller. Always keep it in an easily accessible location. Include this manual with the controller should the controller change hands.

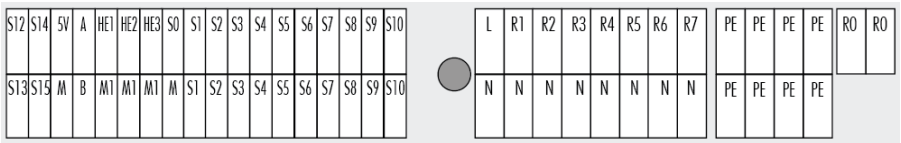
If this manual gets lost or becomes unusable, you can contact the manufacturer for a new copy.

Table of contents

1 Assignment of the terminals to the system components

The connections in the following table are options that may be used in all hydraulic layouts:

Terminal	Use
S1 to S10	Connections for PT1000 temperature sensor
S0 / M	Radiation sensor input (white core of the radiation sensor at S0, red core at M)
S4 / S4	Temperature sensor of the collector return line for the "Energy yield measurement" function
S13 / 5V	Flow sensor for the "Yield measurement 1" function
S15 / 5V	Flow sensor for the "Yield measurement 2" function
S14 / S15 5V / M	VFS (vortex flow sensor) for the "Flow monitoring" function "Flow" on S14, "Temperature" on S15. Further details can be found in the VFS manufacturer's documentation.
S12 / S13 5V / M	VFS (vortex flow sensor) for the "Flow monitoring" function "Flow" on S12, "Temperature" on S13. Further details can be found in the VFS manufacturer's documentation.
A / B	RS-485 interface (ProBusX) Make sure that the polarity of the bus connection is not mixed up (A-A, B-B). Use paired twisted-conductor cables for connection.
HE 1/ M 1	Power control for high-efficiency pump (HE pump) 1 HE1=Signal M1=GND 230 V power supply for the pump via switching output R1.
HE 2/ M 1	Power control for high-efficiency pump (HE pump) 2 HE2=Signal M1=GND 230 V power supply for the pump via switching output R2.
HE 3/ M 1	Power control for high-efficiency pump (HE pump) HE2=Signal M1=GND



Please note that the different pump manufacturers have different designations for the PWM connectors. An example with Grundfos and Wilo:

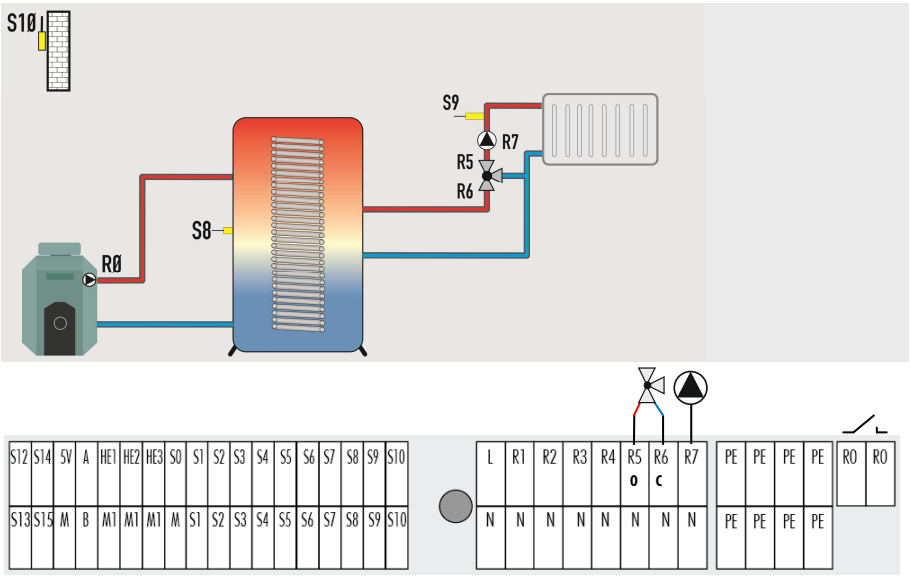
Controller terminal	Pump manufacturer	
	Grundfos	Wilo
HE1	PWM input (brown)	PWM+
M	Signal ref. (blue)	PWM-

2 Hydraulic layouts – heating circuit

The inputs and outputs of each heating circuit can be assigned either **internally** directly in the controller or **externally** to a connected flex 400.

2.1 One heating circuit

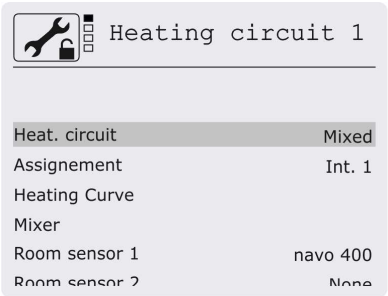
One heating circuit, mixed



HC1	For all heating circuits
S9 sensor for supply line to HC 1* When analog mixer: HE2 R5 mixer for HC 1 open * R6 mixer for HC 1 close * R7 pump for HC 1	S8 sensor for middle of storage tank S10 sensor for outdoor temperature R0 boiler request

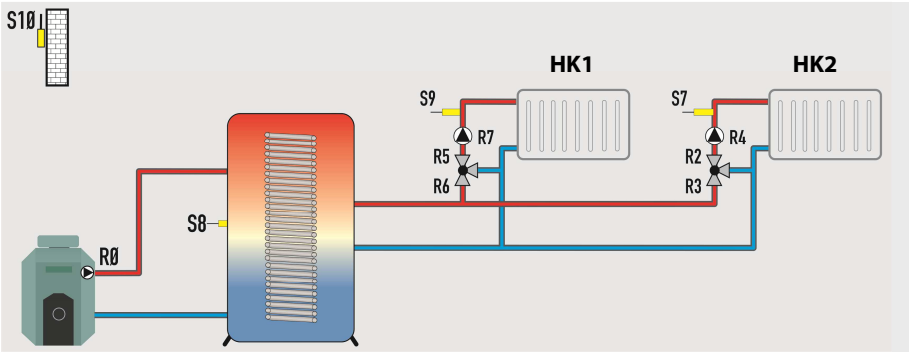
* There are no mixer and supply line sensor when unmixed

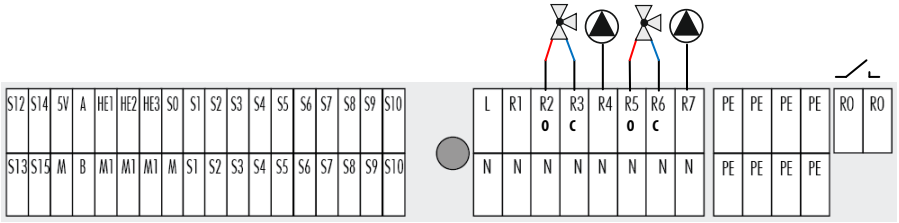
Activating heating circuit 1



2.2 Two heating circuits

Two heating circuits, mixed

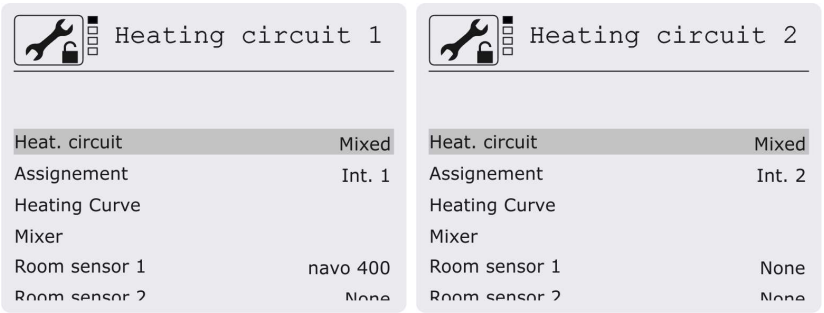




HC1	HC2	For all heating circuits
S9 sensor for supply line to HC 1*	S9 sensor for supply line to HC 2*	S8 sensor for middle of storage tank
		S10 sensor for outdoor temperature
R5 mixer for HC 1 open *	R2 mixer for HC 2 open *	R0 boiler request
R6 mixer for HC 1 close *	R3 mixer for HC 2 close *	
R7 pump for HC 1	R4 pump for HC 2	
When analog mixer: HE2	When analog mixer: HE1	

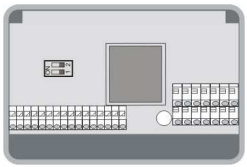
* There are no mixer and supply line sensor when unmixed

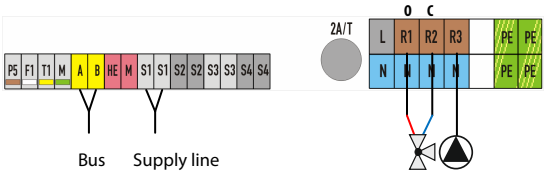
Activating heating circuit 1 and heating circuit 2



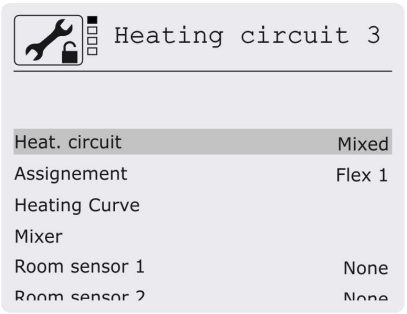
2.3 Additional heating circuits via flex 400 modules (external assignment)

The flex 400 is designed to expand the functions of controllers from the grandis family by adding an additional heating circuit. If several flex 400 modules are connected to the bus, the DIP switches (addressing) in the flex 400 must be set by hand.

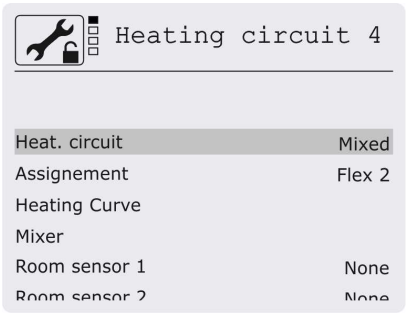




Activating heating circuit 3, assignment: flex 400 Nr. 1



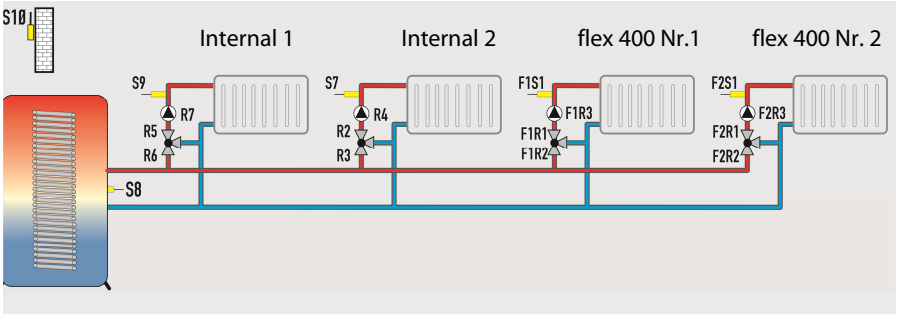
Activating heating circuit 4, assignment: flex 400 Nr. 2



Four mixed heating circuits – internal and external assignment

All the heating circuits (**up to 4**) can be assigned externally either partly or completely. A flex 400 module can be assigned with a mixed or an unmixed heating circuit.

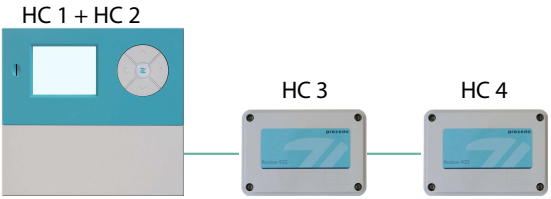
Example of a hydraulic layout with 2 flex 400-modules:



Four mixed heating circuits. Assignment: 2x internal, 2x flex 400

HC1: internal 1	HC2: internal 2	HC3: flex 400 Nr. 1	HC4: flex 400 Nr. 2
S9 sensor for supply line to HC 1 R5 mixer open R6 mixer close R7 pump for HC 1	S7 sensor for supply line to HC 2 R2 mixer open R3 mixer for HC 2 close R4 pump for HC 2	FB1S1 sensor for supply line to HC 3 F1R1 mixer open F1R2 mixer close F1R3 pump for HC 3	FB2S1 sensor for supply line to HC 4 F2R1 mixer open F2R2 mixer close F2R3 pump for HC 4
Common sensors and outputs for all heating circuits: S8 sensor for middle of storage tank S10 sensor for outdoor temperature R0 boiler request			

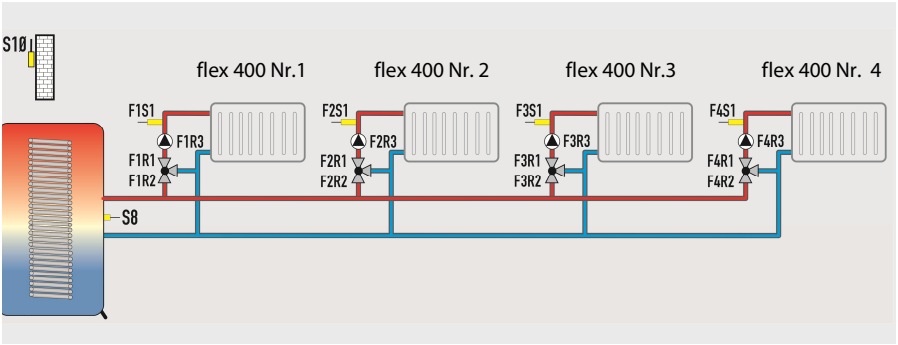
There are no mixer and supply line sensor when unmixed



Note: If the flex 400 is not programmed as a heating circuit, it can be used in addition as a multi-function controller.

Four heating circuits with external assignment

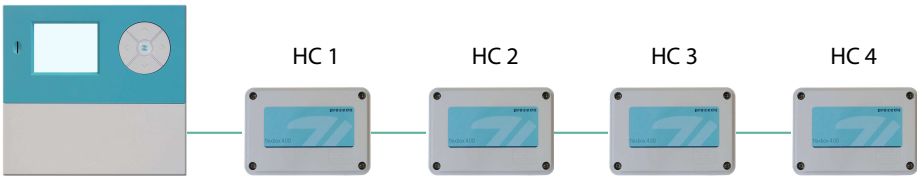
Example of hydraulic layout with 4 flex 400-modules:



Four mixed heating circuits. Assignment: 4x flex 400

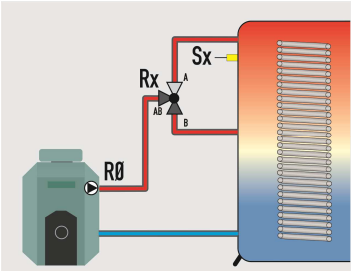
HC1: flex 400 Nr. 1	HC2: flex 400 Nr. 2	HC3: flex 400 Nr. 3	HC4: flex 400 Nr. 4
F1S1 sensor for supply line to HC 1	F2S1 sensor for supply line to HC 2	F3S1 sensor for supply line to HC 3	F4S1 sensor for supply line to HC 4
F1R1 mixer open F1R2 mixer close F1R3 pump for HC 1	F2R1 mixer open F2R2 mixer close F2R3 pump for HC 2	F3R1 mixer open F3R2 mixer close F3R3 pump for HC 3	F4R1 mixer open F4R2 mixer close F4R3 pump for HC 4
Common sensors and outputs for all heating circuits: S8 sensor for middle of storage tank S10 sensor for outdoor temperature R0 boiler request			

There are no mixer and supply line sensor when unmixed



2.4 Priority charging of the process water area

For priority charging of the process water area you can activate the multi-function controller **HW reheating**. This function switches in parallel to the "Hot water" function. The three-way valve switches over. This results in the upper storage tank area being heated first..



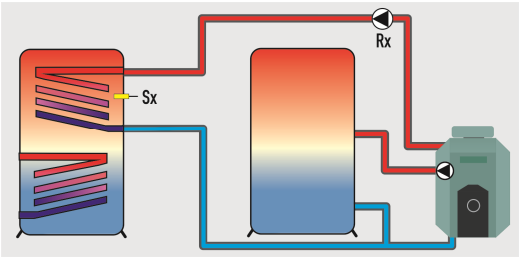
Sx sensor for top of storage tank

Sensor can be freely selected

Rx MFC at output Rx

Output can be freely selected

Alternatively you can use the function for actuating the process water pump. This is also possible when e.g. the hot water storage tank and buffer are separated from each other.



2.5 Hydraulic layout 000.00

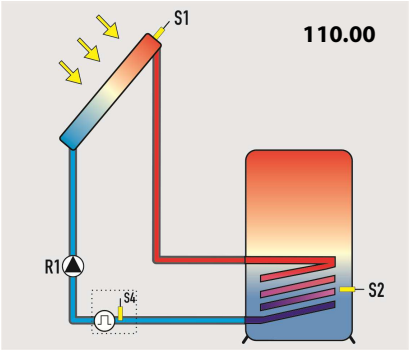
In layout 000.00 you can use all outputs as multi-function controllers.

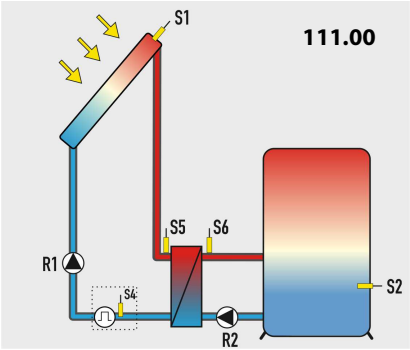
Terminal	Use
R1 + N + PE	Multi-function controller on switching output R1
R2 + N + PE	Multi-function controller on switching output R2
R3 + N + PE	Multi-function controller on switching output R3
R4 + N + PE	Multi-function controller on switching output R4
R5 + N + PE	Multi-function controller on switching output R5
R6 + N + PE	Multi-function controller on switching output R6
R7 + N + PE	Multi-function controller on switching output R7
R0 + R0	Multi-function controller on switching output R0 (potential-free normally open contact)
HE1 + M1	Multi-function controller on switching output HE1 (PWM and PWM invert)
HE2 + M1	Multi-function controller on switching output HE2 (PWM and PWM invert)
HE3 + M1	Multi-function controller on switching output HE3 (PWM and PWM invert)

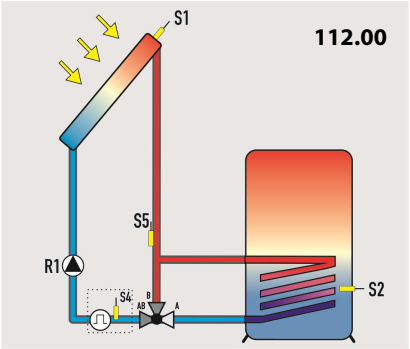
Every Flexbox has a total of 3 outputs. They all can be assigned in multi-function controllers if the Flexbox is not already assigned as a heating circuit controller.

3 Hydraulic layouts - solar

3.1 Hydraulic layouts 110.00, 111.00, 112.00







S12	S14	5V	A	HE1	HE2	HE3	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
								X	X			(X)					
S13	S15	M	B	M1	M1	M1	M	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
								X	X			(X)					

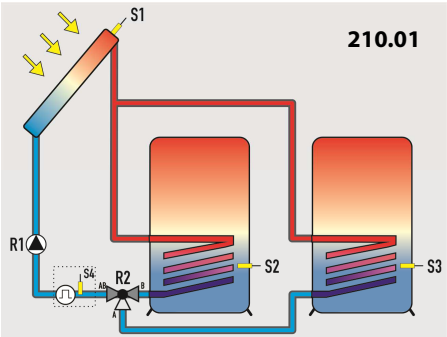
L	R1	R2	R3	R4	R5	R6	R7
X	X	(X)					
N	N	N	N	N	N	N	N
X	X	(X)					

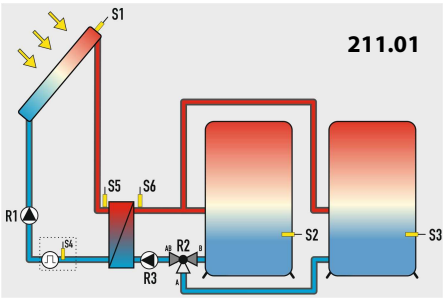
PE	PE	PE	PE
X			
PE	PE	PE	PE
X	(X)		

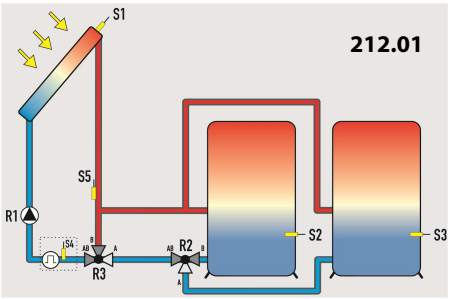
RO	RO

Terminal	Use
R1 / N / PE	Solar circuit pump. Power control for high-efficiency pump on HE1/M1.
(R2 / N / PE)	111.00: Secondary pump. Power control for high-efficiency pump on HE2/M1. 112.00: Three-way valve for bypass function
S1 / S1	Temperature sensor for collector
S2 / S2	Temperature sensor for storage tank
(S4 / S4)	Temperature sensor of the collector return line for the "Energy yield measurement" function
(S5 / S5)	111.00/112.00: Temperature sensor for collector feed
(S6 / S6)	111.00: Temperature sensor for storage tank feed

3.2 Hydraulic layouts 210.01, 211.01, 212.01







S12	S14	5V	A	HE1	HE2	HE3	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
								X	X	X		(X)					
S13	S15	M	B	M1	M1	M1	M	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
								X	X	X		(X)					

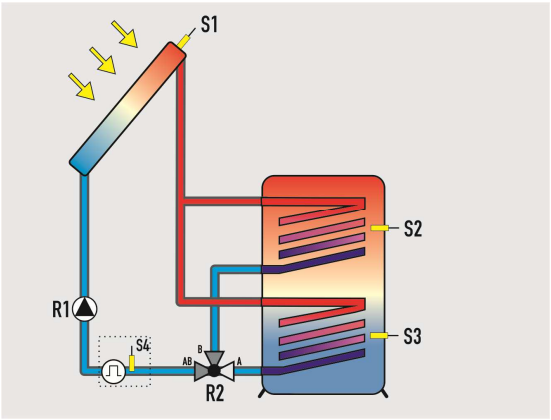
L	R1	R2	R3	R4	R5	R6	R7
X	X	X	(X)				
N	N	N	N	N	N	N	N
X	X	X	(X)				

PE	PE	PE	PE
X	X		
PE	PE	PE	PE
X	(X)		

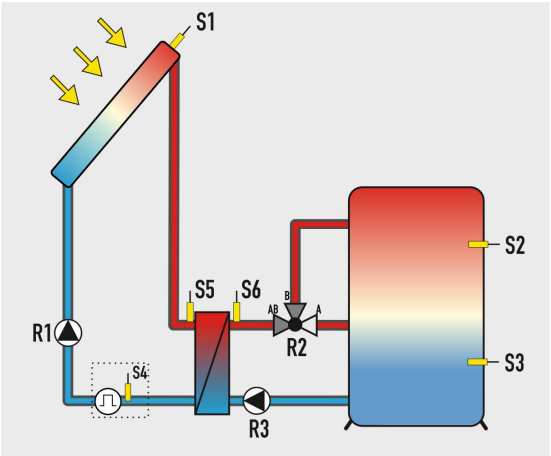
RO	RO

Terminal	Use
R1 / N / PE	Solar circuit pump. Power control for high-efficiency pump on HE1/M1.
R2 / N / PE	Three-way valve
(R3 / N / PE)	211.01: Secondary pump. Power control for high-efficiency pump on HE2/M1. 212.01: Three-way valve for bypass function
S1 / S1	Temperature sensor for collector
S2 / S2	Temperature sensor for storage tank 1
S3 / S3	Temperature sensor for storage tank 2
(S4 / S4)	Temperature sensor of the collector return line for the "Energy yield measurement" function
(S5 / S5)	211.01/212.01: Temperature sensor for collector feed
(S6 / S6)	211.01: Temperature sensor for storage tank feed

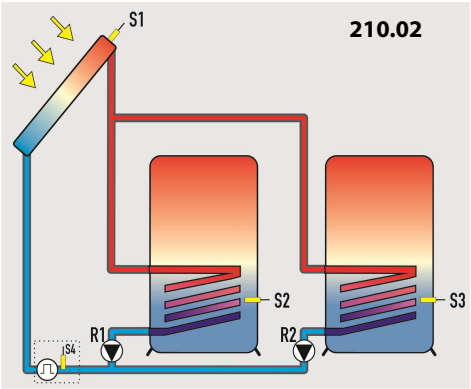
Alternative to 210.01: 2-loading zones

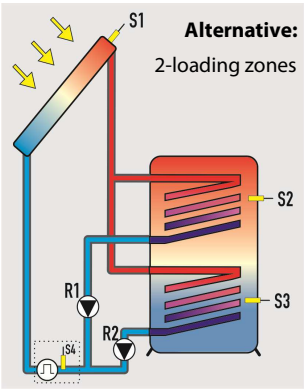


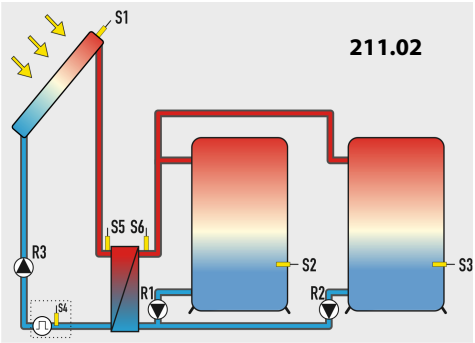
Alternative to 211.01: stratification

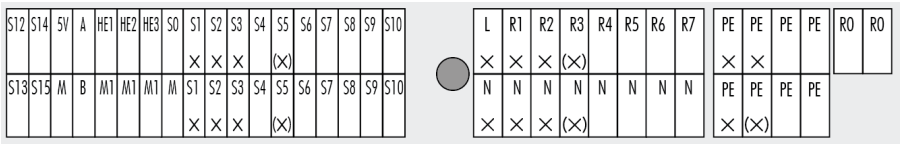


3.3 Hydraulic layouts 210.02, 211.02



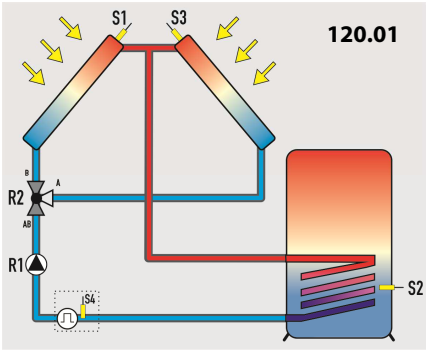


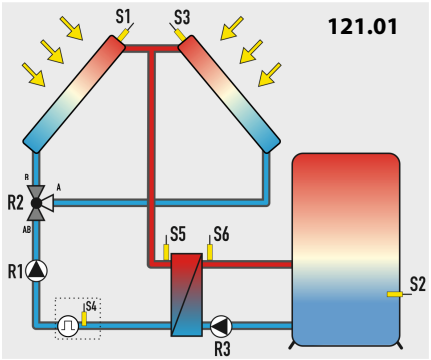


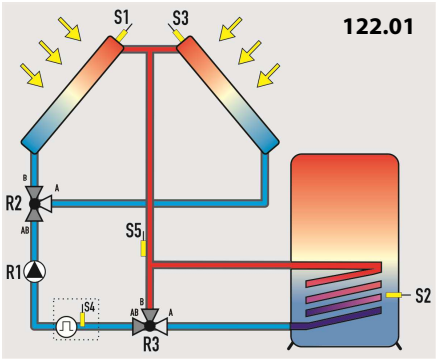


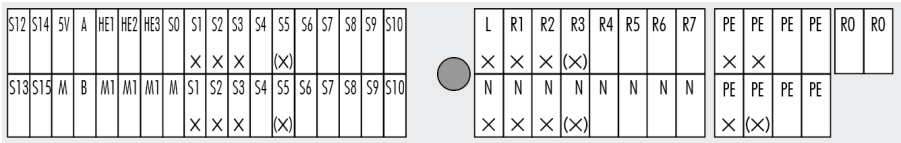
Terminal	Use
R1 + N + PE	Pump for storage tank 1. Power control for high-efficiency pump on HE1/M1
R2 + N + PE	Pump for storage tank 2. Power control for high-efficiency pump on HE2/M1
(R3 + N + PE)	211.02: Solar circuit pump
S1 + S1	Temperature sensor for collector
S2 + S2	Temperature sensor for storage tank 1
S3 + S3	Temperature sensor for storage tank 2
(S4 / S4)	Temperature sensor of the collector return line for the "Energy yield measurement" function
(S5 / S5)	211.02: Temperature sensor for collector feed
(S6 / S6)	211.02: Temperature sensor for storage tank feed

3.4 Hydraulic layouts 120.01, 121.01, 122.01



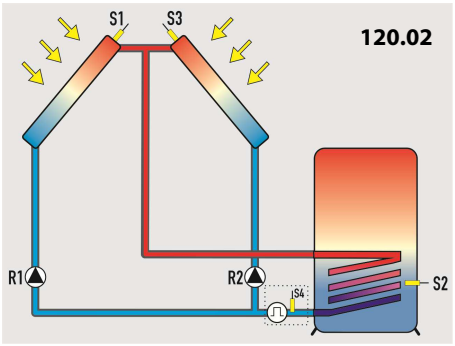


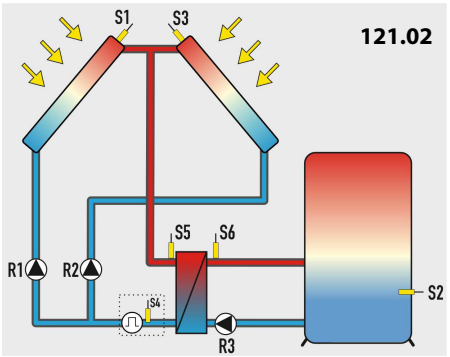


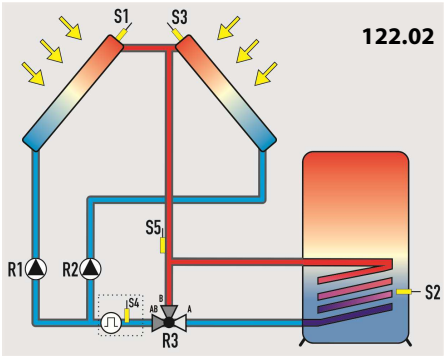


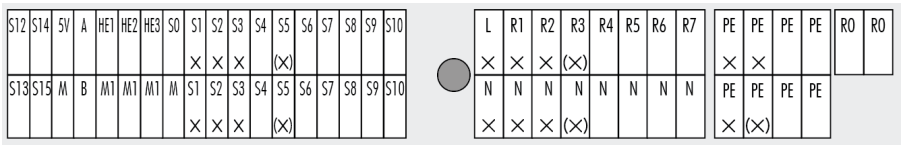
Terminal	Use
R1 + N + PE	Solar circuit pump. Power control for high-efficiency pump on HE1/M1
R2 + N + PE	Three-way valve
(R3 + N + PE)	121.01: Secondary pump. Power control for high-efficiency pump on HE2/M1 122.01: Three-way valve for bypass function
S1 + S1	Temperature sensor for collector 1
S2 + S2	Temperature sensor for storage tank
S3 + S3	Temperature sensor for collector 2
(S4 / S4)	Temperature sensor of the collector return line for the "Energy yield measurement" function
(S5 / S5)	121.01/122.01: Temperature sensor for collector feed
(S6 / S6)	121.01: Temperature sensor for storage tank feed

3.5 Hydraulic layouts 120.02, 121.02, 122.02









Terminal	Use
R1 + N + PE	Pump for collector 1. Power control for high-efficiency pump on HE1/M1
R2 + N + PE	Pump for collector 2. Power control for high-efficiency pump on HE2/M1
(R3 + N + PE)	121.02: Secondary pump 122.02: Three-way valve for bypass function
S1 + S1	Temperature sensor for collector 1
S2 + S2	Temperature sensor for storage tank
S3 + S3	Temperature sensor for collector 2
(S4 / S4)	Temperature sensor of the collector return line for the "Energy yield measurement" function
(S5 / S5)	121.02/122.02: Temperature sensor for collector feed
(S6 / S6)	121.02: Temperature sensor for storage tank feed

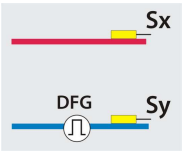
4 Options

4.1 Energy yield

You can program independent energy yield measurements.

With yield measurement 1 (set as independent) and energy yield 2, it is possible to measure the energy yield in any hydraulic circuit.
This is also possible with energy yield 3 to 6 when flex 400 modules are optionally connected.

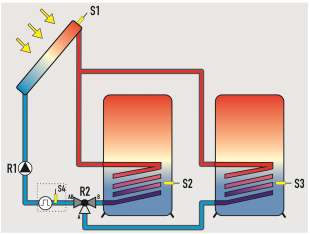
An additional flow sensor or vortex flow sensor is needed for this. This additional sensor must be installed in the hydraulic circuit which is to be measured. Note the flow sensor specifications.



Sx sensor for supply line
Sy sensor for return line

Sensor can be freely selected

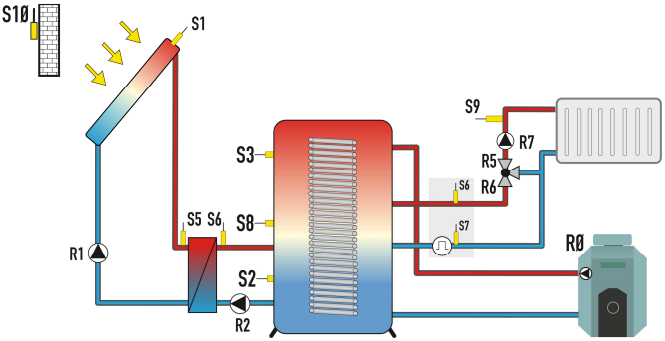
Yield measurement 1 as solar yield measurement. Example with layout 210.01:



S1 sensor for supply line
S4 sensor for return line
S13/5V flow sensor

The solar yield for both storage tanks will be separately determined and displayed, depending on the charging.

Yield measurement 1 as independent energy yield measurement. Example:

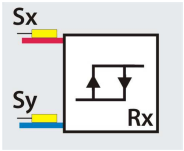


S6 sensor for supply line

S7 sensor for return line

4.2 Multi-function controller

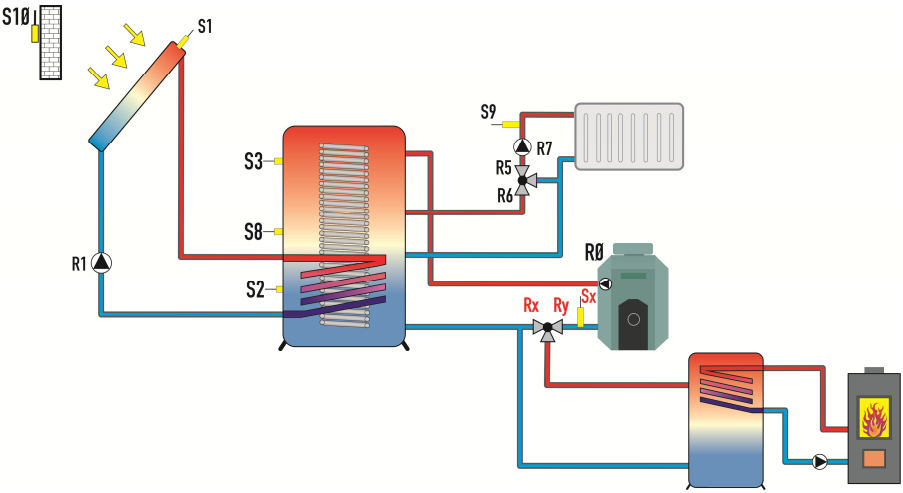
All basic layouts can be extended as required using multi-function controllers. Each free output can be assigned as a multi-function controller.



Up to 6 MFCs can be connected

Sensor can be freely selected

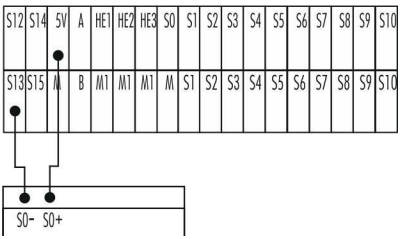
For **Mixer multi-function controllers** you must assign 2 outputs. Example layout:



For additional information and preconfigured parameter sets go to www.prozeda.de/mfr

For the **Yield multi-function controllers** please note:
S0+ to 5V; S0- to the sensor input.

Example with S13



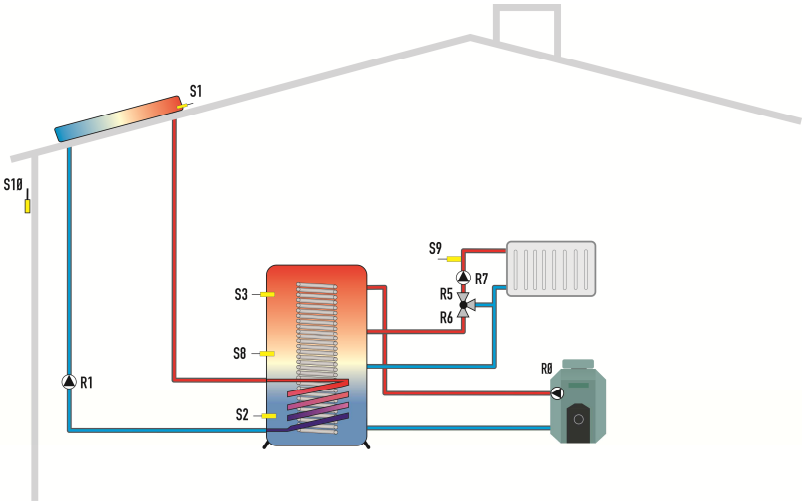
5 Example layouts

There are many different system layouts for the modular construction of solar circuits and heating circuits.

If multi-function controllers are also used, the number of combinations and variations becomes virtually limitless.

The following layouts are examples only.

1 heating circuit with hot water processing + solar



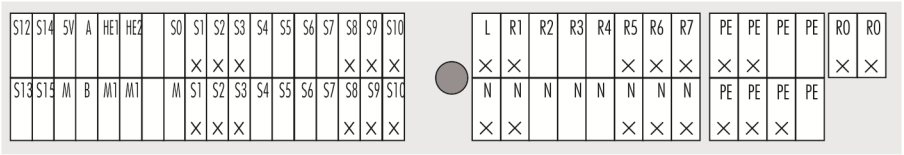
Configuring the system:

① Setting the solar layout

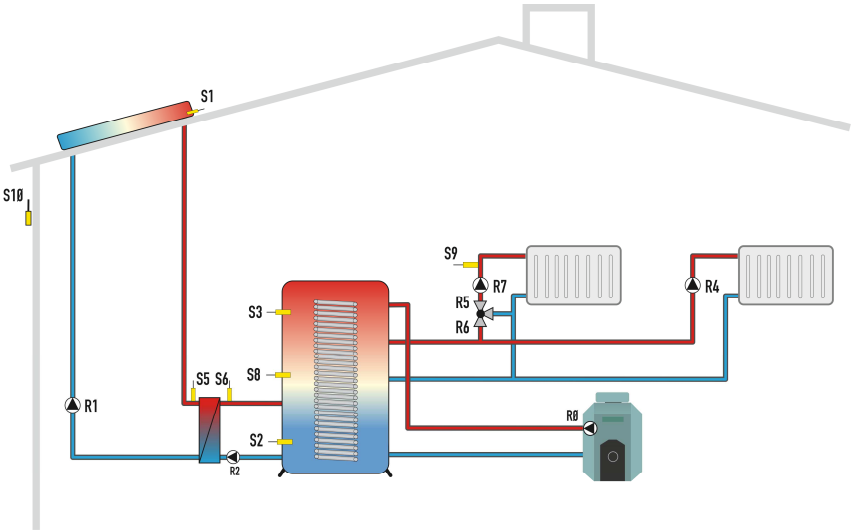
Solar circuit	
Hydraulic layout	110.00
Speed	
Charging method	DeltaT
Collector prot	Off
Drain-Back	Off
Tube collector	Off

② Activating the heating circuit

Heating circuit 1	
Heat. circuit	Mixed
Assignement	Int. 1
Heating Curve	
Mixer	
Room sensor 1	navo 400
Room sensor 2	None



1 mixed + 1 unmixed heating circuit, hot water processing + solar with external heat exchanger



Configuring the system:

① Setting the solar layout ② Activating heating circuit 1 ③ Activating heating circuit 2

Solar circuit

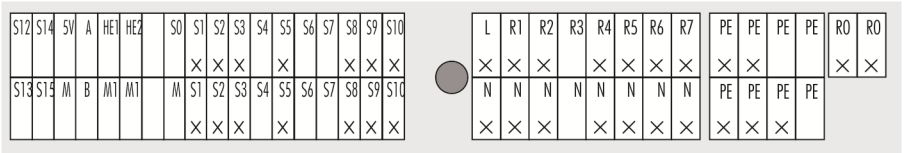
Hydraulic layout	111.00
Speed	
Charging method	DeltaT
Collector prot	Off
Drain-Back	Off
Tube collector	Off

Heating circuit 1

Heat. circuit	Mixed
Assignement	Int. 1
Heating Curve	
Mixer	
Room sensor 1	navo 400
Room sensor 2	None

Heating circuit 2

Heat. circuit	Mixed
Assignement	Int. 2
Heating Curve	
Mixer	
Room sensor 1	None
Room sensor 2	None



To download more examples with parameter sets go to **prozeda.de/mfr**.

6 Combination possibilities

	1 HC m / MFC	1 HC u / MFC	2 HC m / MFC	2 HC u / MFC	2 HC (m + u) / MFC
110.00	• / 3	• / 5	• / -	• / 4	• / 2
111.00	• / 2	• / 4	- / 6	• / 3	• / 1
112.00	• / 2	• / 4	- / 6	• / 3	• / 1
120.01	• / 2	• /4	- / 6	• / 3	• / 1
121.01	• / 1	• / 3	- / 5	• / 2	• / -
122.01	• / 1	• / 3	- / 5	• / 2	• / -
120.02	• / 2	• /4	- / 6	• / 3	• / 1
121.02	• / 1	• / 3	- / 5	• / 2	• / -
122.02	• / 1	• / 3	- / 5	• / 2	• / -
210.01	• / 2	• / 4	- / 6	• / 3	• / 1
211.01	• / 1	• / 3	- / 5	• / 2	• / -
212.01	• / 1	• / 3	- / 5	• / 2	• / -
210.02	• / 2	• / 4	- / 6	• / 3	• / 1
211.02	• / 1	• / 3	- / 5	• / 2	• / -
000.00	• / 4	• / 6	• / 1	• / 5	• / 3

HC m = mixed heating circuit, HC u = unmixed heating circuit, MFC = multi-function controller

Every Flex module increases these possibilities with 1 heating circuit (mixed or unmixed) or 3 additional multi-functional controllers.