



District heating controller

RVD250

for 1 heating circuit and d.h.w., communicating

Multifunctional heating controller for district heat transfer stations and plants with LPB and M-bus communication. Suited for the control of 1 heating circuit with d.h.w. heating in instantaneous systems or with d.h.w. storage tank. 28 programmed plant types. Operating voltage AC 230 V.

Use

- Types of plants:
 - Autonomous heating group with own d.h.w. heating system, with connection to a district heat transfer station
 - Interconnected plants consisting of several heating groups each with 1 heating circuit and d.h.w. heating system; in a district heat transfer station
- Types of buildings:
 - Residential and nonresidential buildings with own district heat connection and d.h.w. heating system
- Types of heating systems:
 - All types of standard heating systems, such as radiator, convector, underfloor and ceiling heating systems, including radiant panels
- Types of d.h.w. heating systems:
 - D.h.w. heating with storage tank or in instantaneous systems
 - Common or separate heat exchangers for heating circuit and d.h.w. heating
 - D.h.w. heating with electric immersion heater and solar collector

Functions

Heating circuit control

- Weather-compensated flow temperature control, mixing valve with 3-position actuator
- Weather-compensated flow temperature control with room influence, mixing valve with 3-position actuator
- Room-compensated flow temperature control, mixing valve with 3-position actuator
- Demand-dependent control of the common flow temperature

Precontrol

- Demand-dependent precontrol of heating circuit flow in interconnected plants

D.h.w. control

- D.h.w. heating with coil type storage tanks, with or without mixing valve in the secondary circuit
- D.h.w. heating with stratification storage tanks
- Direct d.h.w. heating off heat exchanger
- D.h.w. heating with electric immersion heater and solar collector

Other functions

- Optimized heating up and setback
- Automatic heating limit (automatic ECO function)
- Frost protection (for the building, plant, and d.h.w.)
- 365-day clock with automatic summer- / wintertime changeover
- Independent time programs for heating circuit and d.h.w. heating
- Adjustable heating period
- Maximum limitation of flow temperature rise and flow alarm
- Analog (DC 0...10 V) and digital input
- PWM output for speed-controlled pump
- Communication via LPB (Local Process Bus) and M-bus
- Pump and valve kick
- Cooling down protection in the case of direct d.h.w. heating off parallel heat exchanger
- Flow switch with adjustable load limit, seasonal adaptation and child-proofing
- Differential temperature limitation for heat exchanger (DRT function)
- Minimum limitation of flow rate for suppression of hydraulic creep
- Relay and sensor test
- Remote control with room unit
- Refill function

Type summary

<i>Description</i>	<i>Instructions in ...</i>	<i>Product no.</i>	<i>Order number</i>
District heating and d.h.w. controller	German, French, English, Italian, Danish, Finnish, Swedish Polish, Czech, Greek, Russian, Bulgarian, Romanian	RVD250-A	S55370-C125

Ordering

Note Sensors, room units, actuators and valves must be ordered as separate items.

Equipment combinations

Suitable sensors and room units

- Flow, return and d.h.w. temperature:
All sensors with sensing element LG-Ni1000, e.g.:
 - Strap-on sensor QAD22
 - Immersion sensors QAE212... and QAP21.3
 - Collector sensor QAP21.2 (solar)
- Room temperature:
 - Room units (PPS) QAA50.110/101 and QAW70
- Outside temperature:
 - Outside sensor QAC22 (sensing element LG-Ni1000)
 - Outside sensor QAC32 (sensing element NTC 575)
- Pressure: Sensors delivering DC 0...10 V signals, e.g.
 - Pressure sensor QBE2002...

Note

The RVD250 controller automatically identifies the type of sensor used.

Suitable actuators

All types of Siemens electromotoric and electrohydraulic actuators for 3-position control operating on AC 24...230 V can be used.

With d.h.w. applications, consideration must be given to actuator running times and sensor time constants. For detailed information, refer to the Basic Documentation. For detailed information about actuators and valves, refer to the respective Data Sheets.

Product documentation

<i>Type of document</i>	<i>Document no.</i>	<i>Stock number</i>
Operating Instructions Language set: de, en, fr, it, da, fi, sv	B2513	74 319 0724 0
Operating Instructions Language set: pl, cs, el, ru, bg, ro	B2513	74 319 0725 0
Installation Instructions Language set: de, en, fr, it, da, fi, sv	G2513	74 319 0722 0
Installation Instructions Language set: pl, cs, el, ru, bg, ro	G2513	74 319 0723 0
Basic Documentation	P2513	STEP Web Client
CE Declaration of Conformity	T2513	STEP Web Client
Environmental Declaration	A5W00059911	STEP Web Client

Technical design

Functioning

The RVD250 controller allows the configuration of 28 different plant types as combinations of heating circuit and d.h.w. heating system.

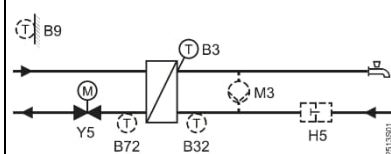
When commissioning a plant, the relevant plant type must be selected and entered. All required functions, settings and displays are then automatically assigned, and parameters that are not required will be hidden.

Note

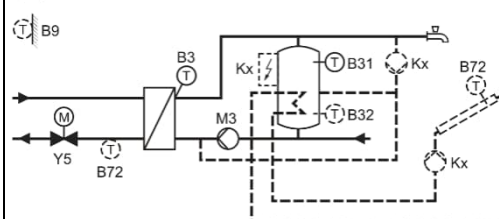
Optional functions are to be configured in addition to the standard functions.

Plant types 0 - x

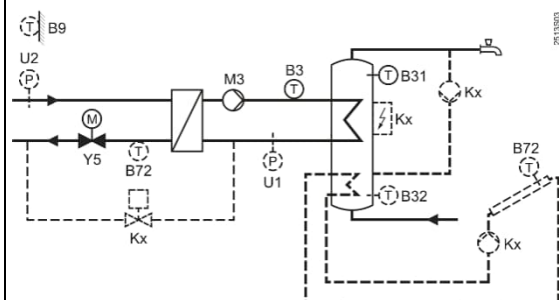
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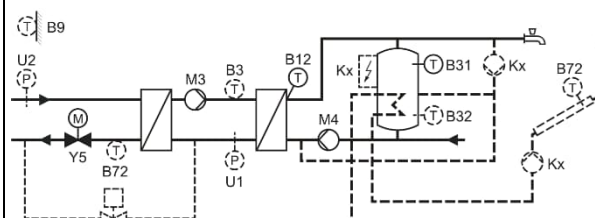
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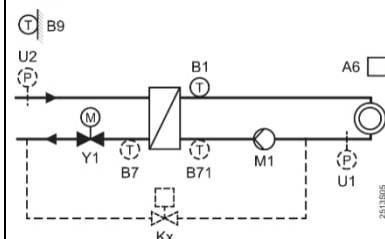


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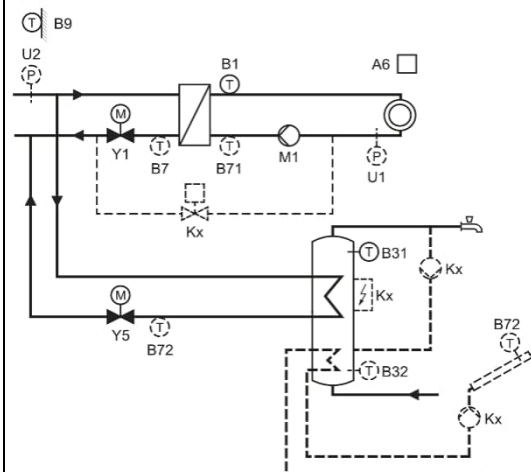


Plant types 1 - x

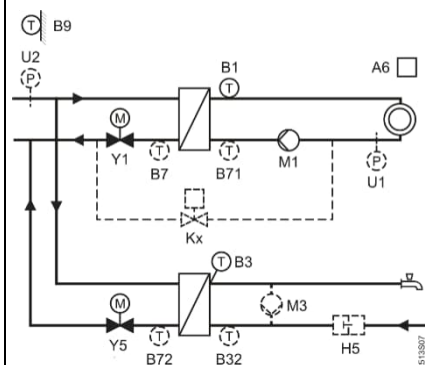
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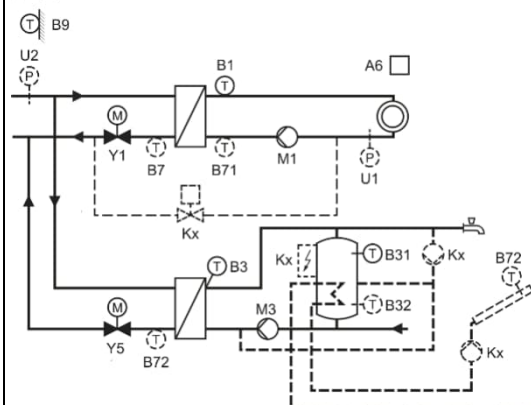
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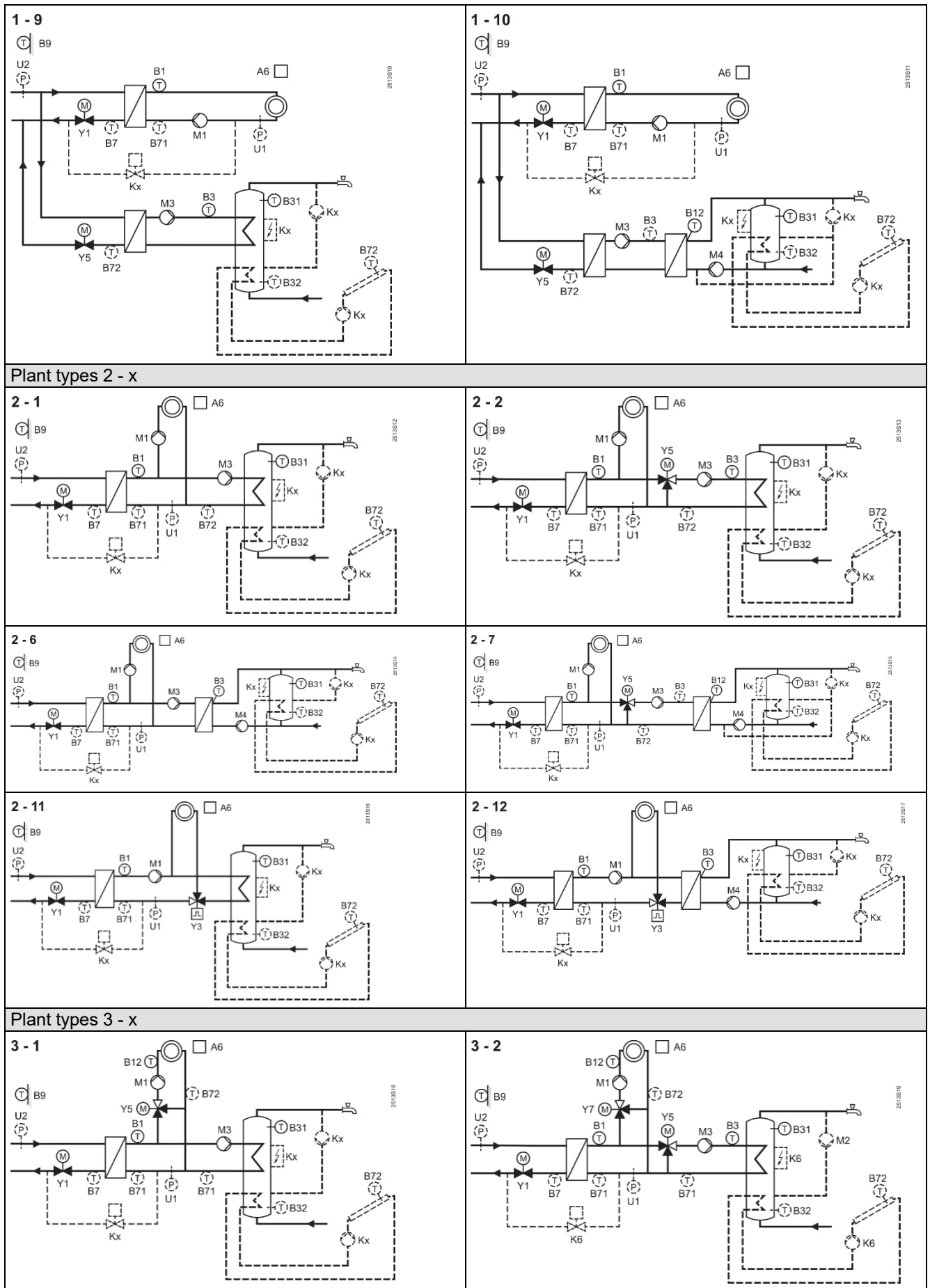


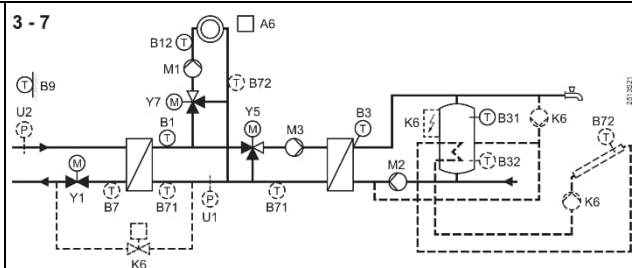
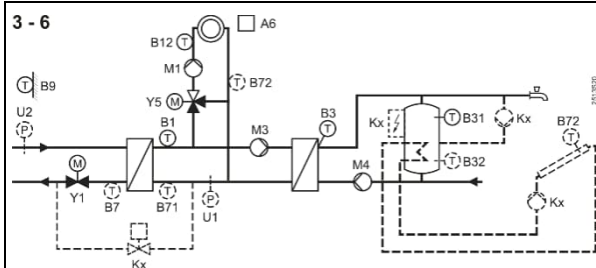
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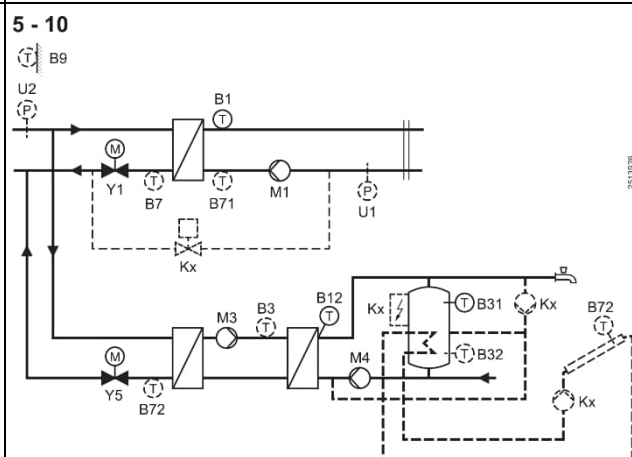
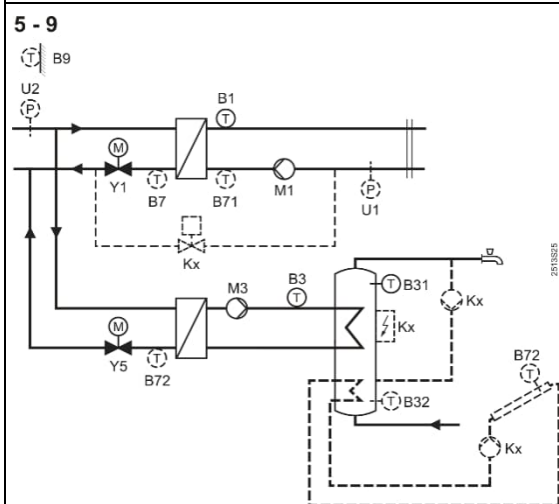
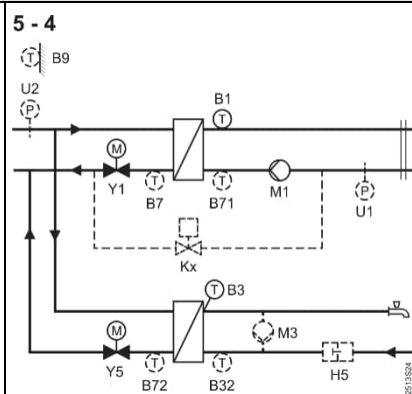
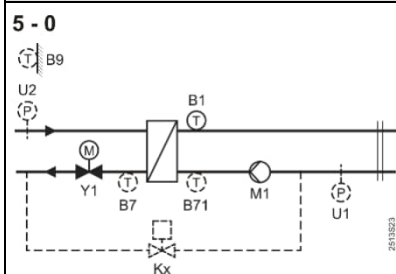
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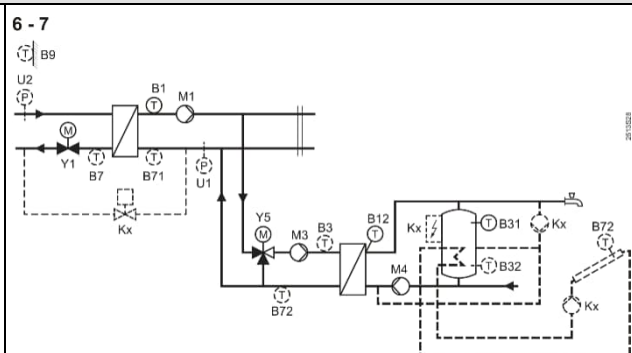
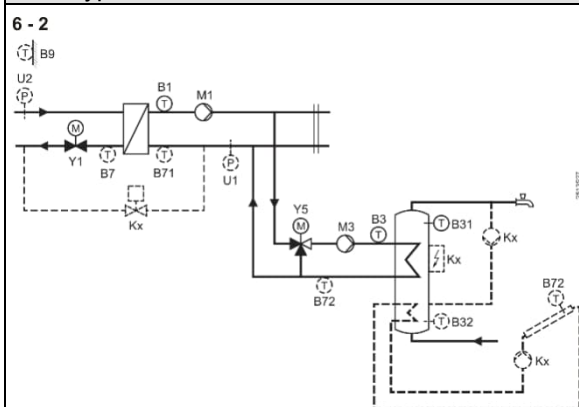


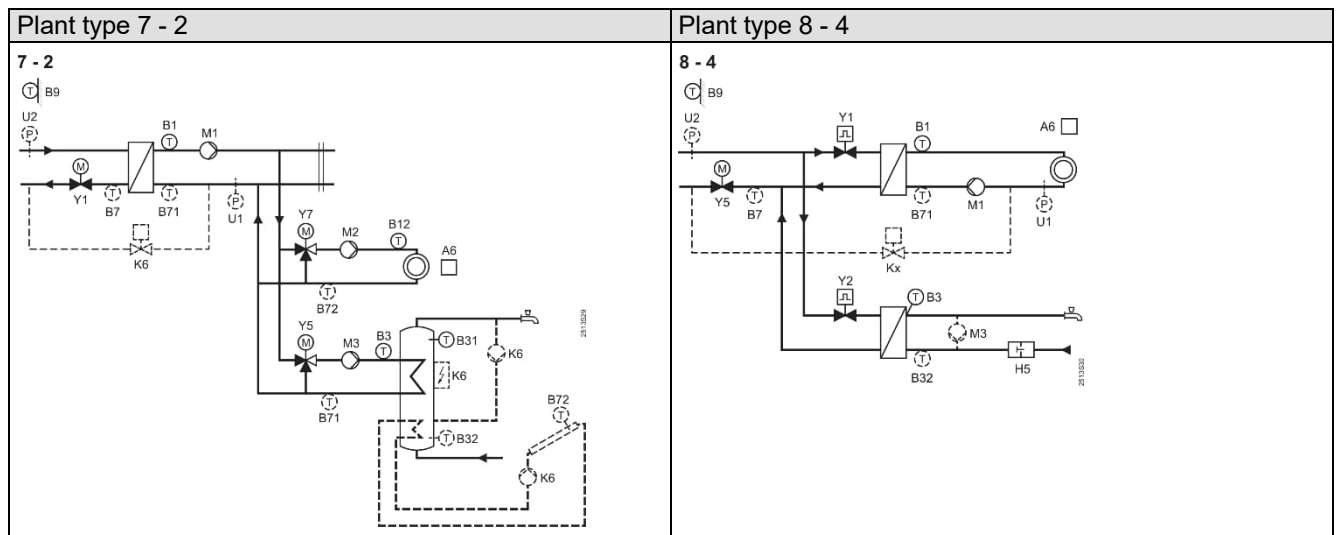


Plant types 5 - x



Plant types 6 - x





Operating modes



Automatic operation

Automatic heating according to the time program; automatic ECO function and room unit active.



Continuous operation

Heating without time program, setpoint according to the setting knob.



Protection

Heating off, frost protection ensured.



Automatic d.h.w. heating



Manual control

No control, pumps in operation.

Notes

- Frost protection is ensured in all operating modes
- The operating mode of the heating circuit has no impact on d.h.w. heating

Heating circuit control

The RVD250 controller provides control of the following types of heating circuits:

- Pump heating circuit off heat exchanger
- Mixing heating circuit off heat exchanger
- Common flow off heat exchanger
- Common flow off heat exchanger and separate mixing heating circuit

Compensating variables

With weather-compensated control, the composite outside temperature is used as the compensating variable. It is calculated (by the controller) from the current and the attenuated outside temperature. The building time constant is adjustable.

Setpoints

Adjustable are the setpoints for the nominal room temperature, the reduced room temperature, and the room temperature for frost protection.

Generation of the flow temperature setpoint

The assigned flow temperature setpoint is generated as follows:

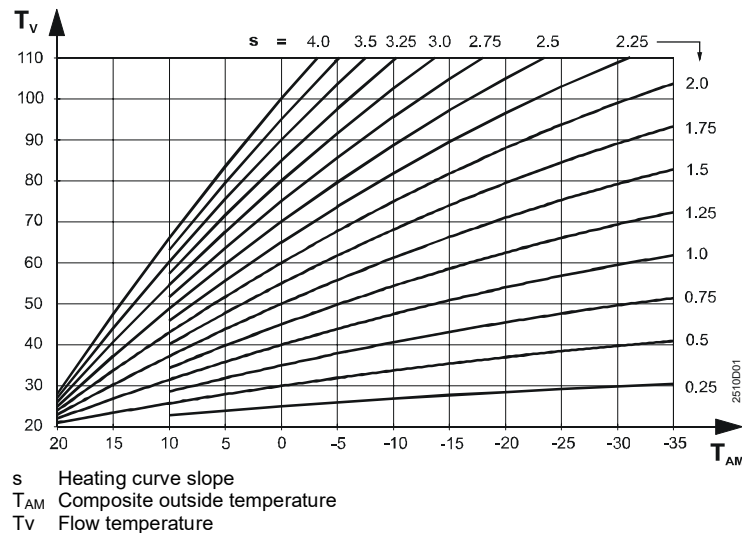
- For weather-compensated control: The setpoint is continuously determined by the outside temperature. The assignment of the flow temperature to the outside temperature is made by the heating curve
- For weather-compensated control with room influence: The setpoint is determined by the outside temperature and, in addition, by the deviation of room temperature setpoint and actual value
- For room-compensated control: The setpoint is determined by the room temperature deviation of setpoint and actual value

A maximum limitation can be set for limiting the rate the flow temperature setpoint increases. Also, a flow alarm is used; the period of time the flow temperature is allowed to remain outside a defined setpoint range can be set. When this period of time has elapsed, an error message is delivered.

Heating circuit control

The control variable for the heating circuit is the secondary flow temperature. With **all** plant types, control is provided via the 2-port valve in the primary return, depending on the plant's total demand for heat (heating circuit and d.h.w. circuit).

Heating curve



Maximum limitation of the return temperature

- Primary circuit: The valve in the primary circuit is driven toward the FULLY CLOSED position when the limit value is exceeded. The characteristic runs constant-shifting-constant, depending on the outside temperature
- Secondary circuit: The valve in the secondary circuit is driven toward the FULLY CLOSED position when the limit value is exceeded. The difference to the primary circuit's limit value must be set

Optimization

Control is optimized; switching on and heating up as well as switching off are controlled such that during occupancy periods the required room temperature is always maintained.

At the end of each occupancy period, the heating is switched off (circulating pump) until the room temperature setpoint for nonoccupancy periods is reached (quick setback, can be deactivated).

Maximum limit values for the heating up time and for early shutdown can be set.

The optimization functions can be deactivated.

Automatic ECO function

The automatic ECO function controls the heating system depending on demand; it is deactivated if permitted by the progression of the outside temperature. For that, consideration is given to the current, the attenuated and the composite outside temperature, as well as an adjustable heating limit.

The automatic ECO function requires an outside sensor. The function can be deactivated, if required.

Maximum and minimum limitation of the flow temperature

Both limitations are effected via the heating curve; at the limit value, the heating curve changes to a constant value. Active limitations are shown on the display. Both limitations can be deactivated.

DRT function

For the differential of primary and secondary return temperature, a maximum limitation can be set.

Pump and valve kick	A kick can be activated for all pumps and valves, aimed at preventing them from seizing. The kick lasts 30 seconds and is made once a week.
Relay and sensor test	To facilitate commissioning and fault tracing, the controller can perform the tests: • Relay test: Each relay can be manually energized • Sensor test: The current sensor values can be queried • Setpoint test: The current setpoints can be queried
Increasing the reduced room temperature	The setpoint of the reduced room temperature can be increased as the outside temperature drops. The rate of increase is adjustable. This function can be deactivated.
Frost protection for the building	Frost protection for the building ensures that an adjustable minimum room temperature is maintained. This function cannot be deactivated.
Frost protection for the plant	Frost protection for the plant protects the heating system against freeze-ups by activating the heating circuit pump. It can be provided with or without outside sensor: • With outside sensor: - Outside temp. $\leq 1.5\text{ °C}$: Heating circuit pump runs for 10 minutes at 6-hour intervals - Outside temp. $\leq -5\text{ °C}$: Heating circuit pump runs continuously • Without outside sensor: - Flow temp. $\leq 10\text{ °C}$: Heating circuit pump runs for 10 minutes at 6-hour intervals - Flow temp. $\leq 5\text{ °C}$: Heating circuit pump runs continuously. This function can be deactivated, if required.
Signal inputs	• Analog input for displaying and forwarding DC 0...10 V signals, or for heat demand DC 0...10 V • Digital input for pulses or signals from a flow switch or heat meter, for heat demand or alarms
Suppression of hydraulic creep	Minimum limitation of the flow rate aimed at suppressing hydraulic creep can act on both the heating circuit and the common primary return. The limitation is ensured by an auxiliary switch in the actuator.
Refill function	The RVD250 controller supports the refill function, aimed at maintaining the plant pressure on the secondary side. If the pressure drops below a minimum value, water is fed from the primary side or a separate tank to the plant's circuit on the secondary side to ensure the pressure will increase again.
Heating period	Outside the adjustable heating period, the heating circuit is switched off. The display shows ECO. Switching off takes place in addition to the automatic ECO function and summer- / wintertime changeover. Frost protection for the building and the plant is maintained. This function has no impact on d.h.w. heating.
Precontrol	Precontrol is accomplished via the valve in the heat exchanger's primary return, depending on demand. The heat demand signal is delivered via the LPB data bus.

D.h.w. heating	The RVD250 controller provides d.h.w. control with the following plant types and d.h.w. heating systems: • Stratification storage tank with charging pump (or diverting valve) and 2 sensors, with or without mixing valve in the d.h.w circuit (or intermediate circuit) • Coil type storage tank with intermediate circuit pump and 2 sensors, with or without mixing valve in the d.h.w. circuit • Directly off system's own heat exchanger The heat for the d.h.w. circuit can be supplied either by the system's own heat exchanger or the common flow (heating circuits and d.h.w. circuit).
Settings	The nominal and the reduced setpoint, maximum setpoint, setpoint increase, switching differential, overrun time of charging pump, and the maximum duration of d.h.w. charging are adjustable.
Frost protection for d.h.w.	A minimum d.h.w. temperature of 5 °C is always ensured.
Manual charging	• Independent of time program and temperature conditions • During protection of heating circuit
Limitation	The maximum limitation of the primary return temperature can be adjusted. The adjusted limit value is independent of heating circuit control.
Releases	The release of d.h.w. charging and the circulating pump can be selected: • Always (24 hours a day) • According to own d.h.w. time program • During the controller's heating circuit time program (d.h.w. charging with forward shift of first daily release)
Priority	The behavior of the heating circuit during d.h.w. charging can be selected: • Absolute: Heating circuit pump OFF, or heating circuit mixing valve FULLY CLOSED and pump ON • Shifting: Heating circuit pump remains ON as long as heat is available. Control to the d.h.w. temperature setpoint or the maximum setpoint • Parallel: No priority; heating circuit remains ON. Control to the d.h.w. temperature setpoint or the maximum setpoint
Cooling down protection	In the case of instantaneous systems, the heat exchanger's primary side is heated up at certain intervals.
Flow switch	To improve the heat exchanger's control performance, with adjustable load limit and for seasonal adaptation and as child-proofing (flow switch prevents control from responding too frequently).
Forced charging	D.h.w. charging takes place daily, always at the time of the first release (or at midnight with the 24-hour program). It is performed also when the actual value lies within the switching differential.
Legionella function	The d.h.w. is heated up at certain intervals to ensure protection against legionella viruses.
Electric immersion heater and solar collector	In the case of plant types with d.h.w. storage tank, the 2 multifunctional relays for d.h.w. heating with electric immersion heater and solar collector can be parameterized.
Note	Availability of the above mentioned functions depends on the type of d.h.w. heating.

Miscellaneous functions

Time switch programs

For automatic operation, the RVD250 controller has a 7-day program with 3 adjustable heating periods per day. Another 7-day program is available for the release of d.h.w. charging.

Using the 365-day clock with automatic summer- / wintertime changeover, a maximum of 8 holiday periods can be programmed. During holiday periods:

- Heating circuit control is in protection mode and the d.h.w. will not be heated

Remote control with room unit

- Room unit QAA50.110/101: Changeover of operating mode, setting the room temperature setpoint, and room temperature readjustment
- Room unit QAW70: Overriding setpoints, the heating program and the holiday program

PWM output

A PWM (pulse width modulation) output is available for the connection of a speed-controlled pump.

Pulse lock for actuators

To reduce wear and tear on the relay contacts, the total duration of the OPEN / CLOSE pulses delivered to an actuator is limited to 5 times its running time.

Communication

- Via LPB, e.g. assignment of d.h.w., master-slave assignments for the time switch, reception of outside temperature signal, reception of heat demand (when RVD250 is used as a primary controller)
- Via M-bus

Manual control

In the case of manual control, the heating can be controlled manually; d.h.w. heating remains activated. The relays are energized / deenergized as follows:

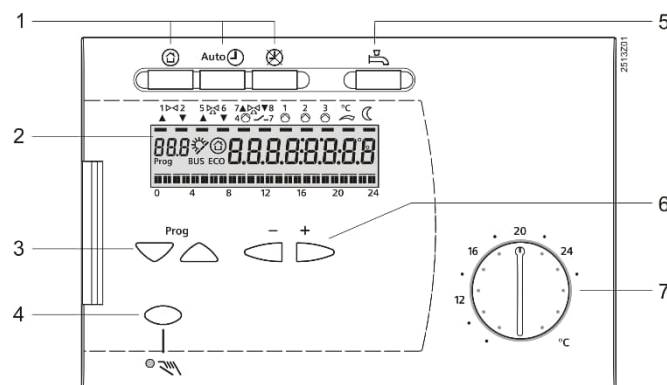
- Actuator driving the primary return valve: Dead, but can be controlled manually from the controller
- Other actuators fully closed, dead
- Heating circuit pump activated
- Collector pump activated and electric immersion heater released

Mechanical design

Controller

The RVD250 consists of controller insert and base. The controller insert accommodates the electronics, the power section and 10 relays. The front carries the operating elements and the backlit display. The controller insert is secured to the base with 2 screws. The base accommodates the connection terminals.

Display and operating elements



- 1 Buttons for selecting the operating mode
- 2 Display (LCD)
- 3 Buttons for selecting the operating lines
- 4 Button for manual control ON / OFF
- 5 Button for d.h.w. heating ON / OFF
- 6 Buttons for adjusting values
- 7 Setting knob for nominal room temperature setpoint

Operation

- Operating elements:
 - Setting knob for the nominal room temperature setpoint
 - Button for the respective operating mode
 - Button for manual control
 - Button for d.h.w. heating
- The setting and readjustment of all other parameters, the activation of functions and reading actual values and statuses follow the operating line principle. An operating line with a number is assigned to each parameter, each actual value and each function. For selection of the operating lines and the adjustment of values, 2 pairs of buttons (3) and (6) are available.
The enclosed Operating Instructions can be inserted in the rear of the cover.

Notes

Engineering

Electrical installation

- The cables of the measuring circuits carry extra low-voltage
- The cables to the actuator and pumps carry AC 24...230 V
- Local regulations for electrical installations must be complied with
- Sensor cables must not be run parallel to mains carrying cables powering actuators, pumps, etc. (safety class II conforming to EN 60730)

Radiator valves

In control systems using a room temperature sensor, the reference room must not be equipped with thermostatic radiator valves; manual valves must be locked in their fully open position.

Refill function

When making use of the refill function, the local regulations and those of the district heat utility must be observed.

Lightning protection

- If bus cables are also laid outside buildings, the devices are exposed to transients of lightning strokes and must be appropriately protected
- Every bus cable and the devices to be protected demand matching protective equipment
- Protection is ensured only if the installation is in proper working order
- For notes on installation in compliance with EMC requirements, refer to Data Sheet CE1N2034

Installation

Types of mounting

- Wall mounting (on a wall, in a control panel, etc.)
- Standard mounting rail (top hat rail)
- Flush mounting (cutout in control panel door, etc.)

Mounting location

Suitable mounting locations are control panels, control desks, compact stations, or the heating room. Not permitted are damp or wet spaces.

Connections

All connection terminals for protective extra low-voltage (sensors and room unit bus) are located on the upper terminal block, those for mains voltage (actuators and pumps) on the lower terminal block.

Commissioning

- Selection of plant type
- The settings can be completely or partly disabled on the software side. In addition, the district heat parameters can be disabled on the hardware side
- The controller is supplied complete with Installation, Mounting and Commissioning Instructions

Disposal



The device is considered electrical and electronic equipment for disposal in terms of the applicable European Directive and may not be disposed of as domestic garbage.

- Dispose of the devices through channels provided for this purpose.
- Comply with all local and currently applicable laws and regulations.

Warranty

When using the RVD250 in connection with third-party devices, correct functioning must be ensured by the user. In that case, Siemens will assume no responsibility for service and warranty.

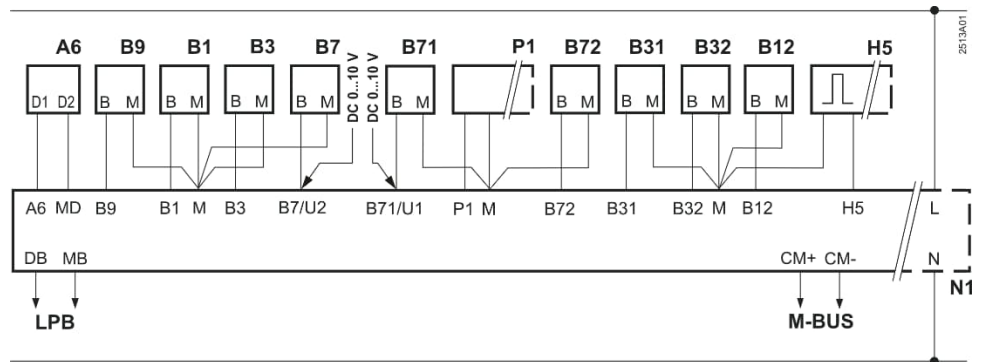
Technical data

Operating voltage	Operating voltage	AC 230 V (+10 / -15%)
	Frequency	50 Hz
	Power consumption (excl. external loads)	Max. 5.5 VA
	External supply line protection	Slow-blow fuse max. 10 A or Circuit breaker max. 13 A Characteristic B, C, D according to EN 60898
Inputs		
Sensor inputs (B...)	Sensing elements	Refer to section "Equipment combinations"
Digital input (H5)	Voltage when contact is open	DC 12 V
	Current when contact is closed	DC 3 mA
	Contact resistance	$R \leq 80 \Omega$
Analog inputs (U...)	Working range	DC 0...10 V
	Input resistance	$R > 100 \text{ k}\Omega$
Outputs		
Relay outputs	Voltage	AC 24...230 V
	Current Y1, Y2, Q1, Q2, Q3, K6, Y7/Q4, Y8/K7	AC 0.02...1 (2) A
	Current Y5, Y6	AC 0.02...2 (2) A
	Switch-on current	Max. 10 A, max. 1 s
	Switching capacity as mixing valve relay	Max. 15 VA
	External supply line protection	See section power supply
PWM output	Idle voltage	12 V
	Internal resistance	1220Ω
	Frequency	2,400 Hz
Interfaces		
LPB	Connection	2-wire (not interchangeable)
	Bus loading number (E)	3
M-bus	Connection	2-wire (interchangeable)
PPS	Connection (room unit or room sensor)	2-wire (interchangeable)

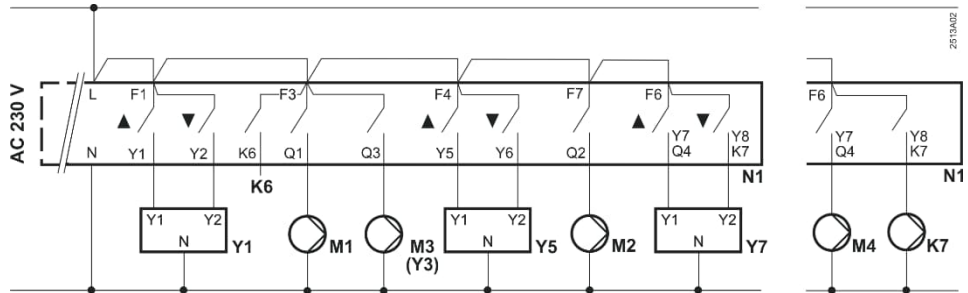
Permissible cable lengths	For all sensors			
	Copper cable 0.6 mm dia.	20 m		
	Copper cable 1.0 mm ²	80 m		
	Copper cable 1.5 mm ²	120 m		
	For room units (PPS)			
	Copper cable 0.25 mm ²	25 m		
	Copper cable from 0.5 mm ²	50 m		
Electrical connections	Screw terminals	For cross-sectional areas up to 2.5 mm ²		
Backup of time switch	Time of day	12 h		
Standards, directives and approvals	Product standard	IEC/EN 60730-Automatic electrical controls for household and similar use		
	1			
	Electromagnetic compatibility (Applications)	For use in residential, commerce, light-industrial and industrial environments		
	EU conformity (CE)	See EU declaration of conformity *)		
	RCM-conformity (EMC)	See RCM declaration of conformity *)		
	EAC conformity	Eurasia conformity (RVD250-A)		
Environmental compatibility	Product environmental declaration (contains data on RoHS compliance, materials composition, packaging, environmental benefit, disposal)	See product environmental declaration *)		
Eco design and labeling directives		Class	Efficiency gain	
	Application with one room temperature sensor and one outdoor temperature sensor and modulating control	VI	4.0%	
*) The documents can be downloaded from http://siemens.com/bt/download .				
Classification according to EN 60730	Software class	A		
	Mode of operation	1B (automatic operation)		
Protection	Protection class	II to IEC/EN 60730 (if correctly installed)		
	Degree of protection of housing	IP40 to EN 60529 (if correctly installed)		
	Pollution class	2 to IEC/EN 60730 (if correctly installed)		
Dimensions	Refer to “Dimensions”			
Weight	Weight (net)	0.85 kg		
Housing colors	Housing	Light-grey RAL 7035		
	Base	Pigeon-blue RAL 5014		
Permissible ambient conditions		Operation IEC/EN 60721-3-3	Transport IEC/EN 60721-3-2	Storage IEC/EN 60721-3-1
	Climatic conditions	Class 3K23	Class 2K12	Class 1K22
	Temperature	-5...+50 °C	-40...+70 °C	-40...+70 °C
	Humidity	<95% r.h. (noncondensing)	<95% r.h.	<95% r.h. (noncondensing)
	Mechanical conditions	Class 3M11	Class 2M4	Class 2M4
	Altitude	Max. 3000 m above sea level		

Connection diagrams

Low voltage side

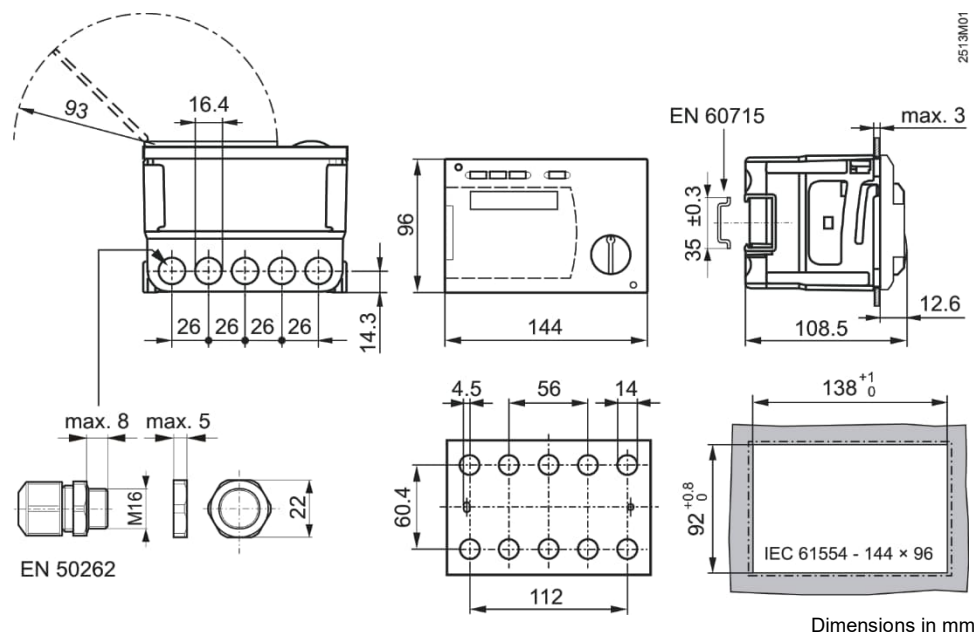


Mains voltage side



- A6 Room unit
- B1 Flow sensor heating circuit / common flow*
- B12 Flow sensor d.h.w. 2 / flow sensor heating circuit
- B3 Flow sensor d.h.w.
- B31 D.h.w. storage tank sensor
- B32 D.h.w. storage tank sensor / return sensor*
- B7 Primary return sensor**
- B71 Secondary return sensor
- B72 Primary / secondary return sensor / collector sensor
- B9 Outside sensor
- H5 Heat meter, flow switch, alarm contact, etc.
- Kx K6, K7 = multifunctional outputs for refill function / electric immersion heater / collector pump / circulating pump / flow alarm*
- N1 Controller RVD250
- P1 Speed-controlled pump (PWM output)
- M1 Heating circuit / system pump
- M2 Heating circuit / storage tank charging / circulating pump*
- M3 D.h.w. intermediate circuit / storage tank charging / circulating pump / diverting valve (Y3)*
- M4 Storage tank charging pump
- U1 Secondary pressure sensor / external heat request
- U2 Primary pressure sensor
- Y1 Actuator of 2-port valve in the primary return
- Y5 Actuator*
- Y7 Actuator*
- * According to plant type
- ** For suppression of hydraulic creep

Dimensions



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 Switzerland
 Tel. +41 58-724 24 24
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