SIEMENS

2381

Series D

District Heating Controller

for one heating circuit and d.h.w.

RVD110
RVD130

- **Controller for use in district heating substations and district heating plants. Control of a pump heating circuit. Domestic hot water (d.h.w.) heating in instantaneous systems or with a storage tank**
- **Eight pre-programmed plant types with automatic assignment of the functions required for each type of plant**
- **Direct analog setting of normal setpoint, other settings are digital using operating lines**
- **Operating voltage AC 230 V, controller for flush panel mounting measuring 96 × 144 mm, conforming to CE**
- **Optional remote operation via room unit**

Use

- Plant:
  Heat exchanger in the district heating substation
- Buildings:
  Residential and non-residential buildings with own district heating connection and d.h.w. heating
- Types of space heating systems:
  All common heating systems, such as radiator, convector, underfloor and ceiling heating systems, or radiating panels
- Types of d.h.w. heating systems:
  - D.h.w. storage tanks or instantaneous systems
  - Common or separate heat exchangers for heating circuit and d.h.w. heating

Functions

Heating circuit control

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

D.h.w. control

- D.h.w. heating via heat exchangers in storage tanks
- Instantaneous d.h.w. heating via heat exchanger with or without mixing valve in the secondary circuit

Additional functions

- Quick setback
- Automatic heating limit (ECO function)
- Frost protection (for the building, plant, and d.h.w.)
- Annual clock for annual holidays, with automatic summer-/wintertime changeover
- Independent time switch programs for room heating and d.h.w.
- Pump kick
- Idle heat function in the case of instantaneous d.h.w. heating via the parallel heat exchanger
- Flow switch with adjustable load limit, protection against tampering and adaptation to the seasons
- Maximum limitation of return temperature differential (DRT-limitation)
- Relay and detector tests
- Remote operation via room unit

Type summary

Unit	*Key feature*	*Type ref.*
District heating and d.h.w. controller	Supports three plant types	**RVD110**
District heating and d.h.w. controller	Supports eight plant types	**RVD130**

Ordering

When ordering, please give type reference according to "Type summary".
Detectors, room unit, actuators and valves must be ordered as separate items.

Equipment combinations

Suitable detectors and room units

Type of detector	*Type reference*	*Data sheet*
Outside detector LG-Ni 1000	**QAC22**	N1811E
Outside detector NTC 575	**QAC32**	N1811E
Clamp-on temperature detector	**QAD22**	N1801E
Immersion temperature detector	**QAE22...**	N1791E
Other detectors using an LG-Ni1000 sensing element	**QA...**	–
Immersion temperature detector Pt 500	standard	–
Room unit	**QAW70**	N1637E
Room unit	**QAW50**	N1635E
Room temperature detector NTC	**QAA10**	N1725E

Suitable actuators

All electrical and electro-hydraulic actuators made by Siemens Building Technologies with the following features can be used:

- Operating voltage AC 24...230 V
- Three-position control

For the different types of actuators and associated valves, refer to data sheets N4000E...N4999E

Suitable room units

Available are two types of room units and a room temperature detector:

Room unit QAW70 with room temperature detector, time switch, setpoint adjustment, and room temperature readjustment (setting knob)

Room unit QAW50 with room temperature detector, and room temperature readjustment (setting knob)

Room temperature detector QAA10

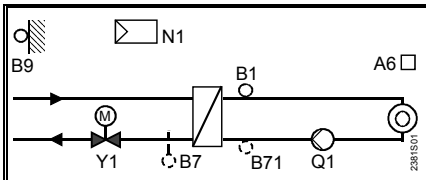
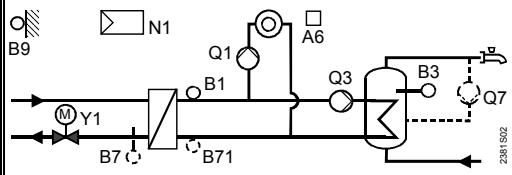
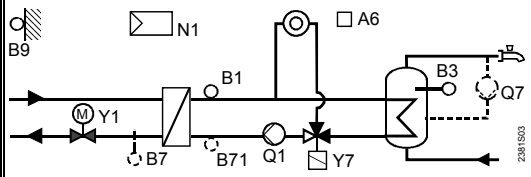
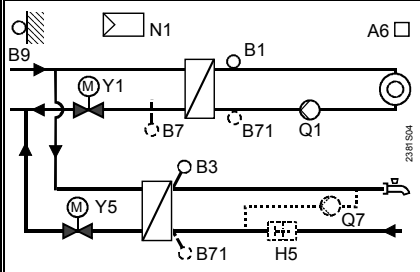
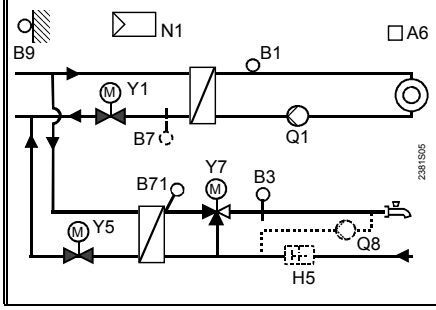
Technical design

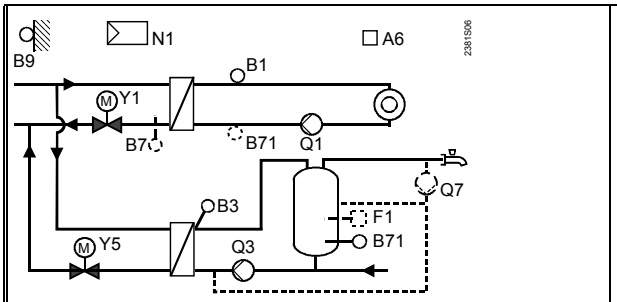
Functioning

- Controller RVD110 has three plant types pre-programmed
- Controller RVD130 has eight plant types pre-programmed

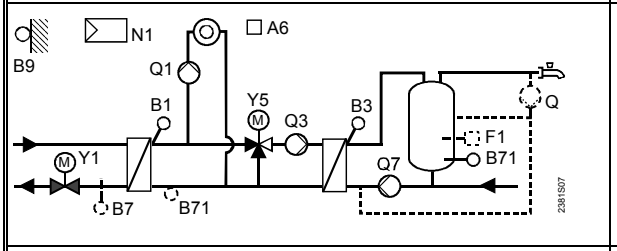
When commissioning the system, the respective plant type must be selected. The required functions, settings and displays will then be automatically assigned. The parameters not required for the plant in question will not be shown.

Plant types

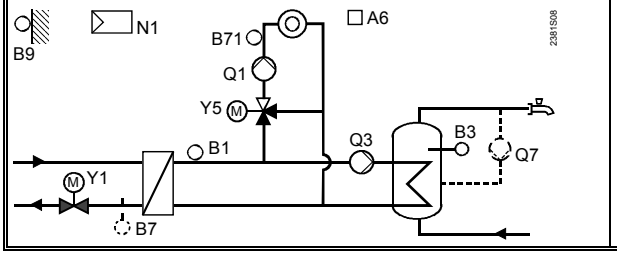
	**Plant type no. 1** Heating circuit control without d.h.w. heating
	**Plant type no. 2** D.h.w. heating with storage tank, d.h.w. charging with charging pump Only RVD130: circulating pump optional
	**Plant type no. 3** D.h.w. heating with storage tank, d.h.w. charging with changeover valve Only RVD130: circulating pump optional
	**Plant type no. 4** Separate heat exchangers for heating circuit and d.h.w., instantaneous d.h.w. heating. Detector B71: • As a d.h.w. temperature detector, **or** • For DRT function Crculating pump and flow switch optional. Selectable idle heat function.
	**Plant type no. 5** Separate heat exchangers for heating circuit and d.h.w., two-stage d.h.w. control: 1st stage in the primary return, 2nd stage with mixing valve in the secondary flow. Flow switch and externally controlled circulating pump optional. Selectable idle heat function.



Plant type no. 6
Separate heat exchangers for heating circuit and d.h.w., instantaneous storage tank connected to separate heat exchanger, d.h.w. charging with charging pump.
Detector B71:
- As a d.h.w. temperature detector (only if there is no circulating pump), **or**
- For DRT function; then, measurement of d.h.w. temp. with thermostat F1



Plant type no. 7
Two heat exchangers connected in series for heating circuit and d.h.w. Instantaneous storage tank connected to the second heat exchanger, with mixing valve control for d.h.w..
Detector B71:
- As a d.h.w. temperature detector, **or**
- For DRT function; then, measurement of d.h.w. temp. with thermostat F1



Plant type no. 8
D.h.w. heating with storage tank connected to the heat exchanger, heating circuit with mixing valve in heating zone flow, d.h.w. charging with charging pump.

A6 Room unit
B1 Flow temperature detector (controlled variable)
B3 D.h.w. temperature detector
B7 Primary return temperature detector
B71 Universal detector according to plant type
B9 Outside detector
F1 D.h.w. thermostat
H5 Flow switch
N1 Controller
Q1 Heating circuit pump
Q3 D.h.w. charging pump
Q7 Circulating pump controlled by the controller
Q Externally controlled circulating pump
Y1 Two-port valve in the primary return
Y5 Valve in the d.h.w. circuit (plant types no. 4, 5, 6), or mixing valve in the d.h.w. circuit (plant type no. 7), or mixing valve in the heating circuit (plant type no. 8)
Y7 Changeover valve (plant type no. 3), or mixing valve in the d.h.w. circuit (plant type no. 5)

Heating circuit control

Operating modes

Automatic operation
Automatic heating according to the time switch program, automatic ECO function and room unit active

Continuous operation
Heating with no time switch program, setpoint adjustment with the setting knob

Standby
Heating off, frost protection ensured

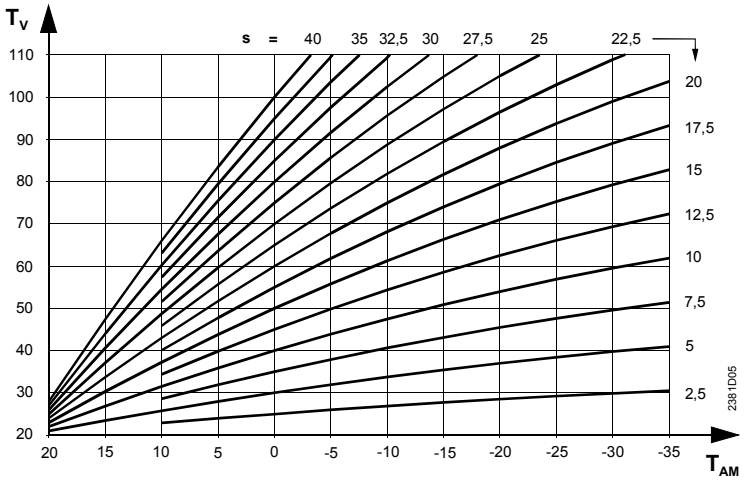
Acquisition of measured values

- Flow temperature detector: LG-Ni 1000 Ω at 0 °C (e.g. QAD22)
- Outside detector: LG-Ni 1000 (QAC22) or NTC 575 (QAC32)
- Primary return temperature detector: LG-Ni 1000 or Pt 500
- Room temperature: with a room unit QAW50 / QAW70 or room temperature detector QAA10

If different types of detectors are used, the controller automatically identifies the type of detector connected.

Compensating variables	With weather-compensated control systems, the composite outside temperature is used as the compensating variable. It is generated from the actual and the attenuated outside temperature (calculated by the controller). Consideration is given to the type of building construction (adjustable for light and heavy buildings).
Setpoints	The following setpoints can be adjusted: • Nominal room temperature • Reduced room temperature • Room temperature for frost protection
Generation of flow temperature setpoint	• Weather-compensated control: the flow temperature setpoint is controlled in function of the prevailing outside temperature via the heating curve • Weather-compensated control with room temperature influence: the flow temperature setpoint is controlled in function of the prevailing outside temperature and, in addition, in function of the deviation of the actual room temperature from the setpoint • Room temperature-compensated control: the setpoint is controlled in function of the deviation of the actual room temperature from the setpoint
Control	The controlled variable is always the secondary flow temperature. In **all** types of plant, it is controlled through a two-port valve in the primary return depending on the plant's total demand for heat (space heating plus – if present – d.h.w.).
Maximum limitation of return temperature	The valve in the primary circuit starts travelling towards the clodes position when the limit value is exceeded. The characteristic is constant-shifting depending on the outside temperature.
Quick setback	When changing from the normal temperature to a lower temperature level (☾ or ❄), the heating will be shut down. • If there is a room temperature detector present, it will be switched on again when the setpoint of the lower temperature level is reached. • If there is no room temperature detector present, quick setback is active during a defined period of time, which depends on the type of building construction and an adjustable gain factor. The function can be deactivated, if required
Automatic ECO function	With the automatic ECO function, the heating is controlled depending on demand. The heating will be shut down if permitted by the outside temperature. Consideration is given to the actual, the attenuated and the composite outside temperature, as well as to an adjustable heating limit. The ECO function requires the use of an outside detector. It can be deactivated, if desired.
Maximum and minimum limitation of flow temperature	Both limitations are accomplished via the heating curve. When the limit value is reached, the heating curve assumes a constant value. Any active limitation is shown on the display. Both limitations can be deactivated.
DRT function	The differential between the primary and the secondary return temperature is limited to a maximum value.
Time switch programs	To provide automatic operation of the heating system, the controller features a weekly program with three heating periods that can be adjusted on a daily basis. Another weekly program is available for the release of d.h.w. charging.
Pump kick	The pump kick is adjustable for the heating circuit pump, the d.h.w. charging pump, and the circulating pump. The pump kick is made once per week and lasts 30 seconds. The function can be deactivated, if required.

Heating curve



s Slope
T_{AM} Composite outside temperature
T_V Flow temperature

Adaptation of heating curve

The heating curve can adapt to ambient conditions. The longer the adaptation is switched on, the shorter the learning steps become.
Sslope, heat gains and parallel displacement can be adjusted.
This function requires a room temperature detector.

Relay and detector tests

To facilitate commissioning and fault tracing, both relay and detector tests can be made:

- Relay test: each of the relays can be manually energized
- Detector test: all detector values can be interrogated

Pulse lock with actuators

The total duration of the closing pulses delivered to an actuator is limited to five times the actuator's running time, in order to extend the life of the relay contacts.

Raising the reduced room temperature

The setpoint of the reduced room temperature can be raised as the outside temperature falls. The increase (effect) is adjustable.
This function can be deactivated, if required.

Frost protection for the building

Frost protection for the building ensures an adjustable minimum room temperature.
This function cannot be deactivated.

Frost protection for the plant

Frost protection for the plant protects the heating plant against freeze-ups through activation of the heating circuit pump. This function can be provided with or without an outside detector:

- With outside detector:
  Outside temperature ≤ 1.5 °C: the heating circuit pump runs for 10 minutes at 6-hour intervals
  Outside temperature ≤ –5 °C: the heating circuit pump runs continuously
- Without outside detector:
  Flow temperature ≤ 10 °C: the heating circuit pump runs for 10 minutes at 6-hour intervals
  Flow temperature ≤ 5 °C: the heating circuit pump runs continuously

This function can be deactivated, if required.

D.h.w. heating

In addition to heating circuit control, the RVD110 / 130 provide control of d.h.w. heating in the following types of plant and d.h.w. systems:

Plant type	*RVD110*	*RVD130*	*D.h.w. system*
1	●	●	–
2	●	●	Storage tank connected to common heat exchanger
3	●	●	Storage tank connected to common heat exchanger
4		●	Instantaneous system connected to a parallel heat exchanger
5		●	Instantaneous system connected to a parallel heat exchanger
6		●	Instantaneous storage tank connected to a parallel heat exchanger
7		●	Instantaneous storage tank connected to common heat exchanger
8		●	Storage tank connected to common heat exchanger

Acquisition of measured values

- Plant types no. 2...8: With a detector LG-Ni 1000 or Pt 500 connected to terminal B3
- Storage tank in plant types no. 6 and 7: With a detector LG-Ni 1000 (terminal B71) or with a thermostat

D.h.w. functions with all types of plant

- Settings: Normal setpoint and reduced setpoint, maximum setpoint, setpoint boost and switching differential
- Frost protection for d.h.w.: a minimum temperature of 5 °C is always maintained
- D.h.w. OFF: d.h.w. heating can be manually switched off
- Maximum limitation of the primary return temperature: adjustable is a limit value independent of heating circuit control

Plant type-specific d.h.w. functions

- Release:
  With plant types no. 2…8, release of d.h.w. heating can be selected:
  - According to own d.h.w. time switch program
  - During the controller's heating periods, with or without forward shift of the first daily release
  - Always (24 hours per day)
- Priority: the behaviour of the heating circuit during d.h.w. charging can be selected:
  - Absolute: heating circuit pump deactivated (plant type no. 8: mixing valve fully closed, heating circuit pump remains activated)
  - Shifting: heating circuit pump remains activated as long as there is sufficient heating energy available (plant type no. 8: mixing valve throttled). The d.h.w. setpoint or maximum setpoint is maintained
  - Parallel: no priority; heating circuit remains ON. The d.h.w. setpoint or maximum setpoint is maintained
- Idle heat function: in instantaneous systems, the heat exchanger’s primary side is periodically heated up
- Flow switch: to improve the heat exchanger’s control performance, with adjustable load limit, adapts to the seasons, tamperproof (prevents the control system from responding too frequently).
- Forced charging: d.h.w. charging takes place every day on the first release (or ad midnight with the 24-hour program). It also takes place if the actual value lies within the switching differential
- Manual charging:
  - Independent of the time switch program and temperature conditions
  - During standby periods

Summary of d.h.w. functions

Function	*Plant type no. 2*	*Plant type no. 3*	*Plant type no. 4*	*Plant type no. 5*	*Plant type no. 6*	*Plant type no. 7*	*Plant type no. 8*
Priority	Selectable	Absolute	Selectable [2])	Selectable [2])	Selectable	Selectable	Selectable
Pump overrun	Active	Active [1])	Not required	Note required	Active [3])	Active [3])	Active
Control of circulating pump [6])	OFF during charging and ⏻	OFF during charging and ⏻	OFF during ⏻	Not planned [5])	OFF during charging and ⏻	Not planned [5])	OFF during charging and ⏻
Frost protection	Yes	Yes	No	No	Yes	Yes	Yes
Idle heat function	No	No	Yes	Yes	No	No	No
Forced charging	Yes	Yes	No	No	Yes	Yes	Yes
Manual charging	Yes	Yes	No	No	Yes	Yes	Yes
Legionella function	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Discharging protection [4])	Yes	Yes	No	No	Yes	Yes	Yes
D.h.w. boost	In the storage tank	In the storage tank	Not required	At the d.h.w. mixing valve	Not required	At the d.h.w. mixing and the heat exchanger	In the storage tank
Flow switch	No	No	Optional	Optional	No	No	No
Release	According to the time switch program or always (selectable)						

[1]) Changeover valve
[2]) Preferably parallel
[3]) If d.h.w. is drawn
[4]) With pump overrun
[5]) Must be controlled externally, if present
[6]) RVD130 only

Extra functions

Remote operation via room units

- Room unit QAW50: changeover of operating mode, room temperature setpoint adjustments and room temperature readjustments
- Room unit QAW70: overriding the setpoints and the heating program, entry of holiday periods

Parameter reset

All settings made can be reset to the factory settings.

Manual operation

In manual operation, the heating can be controlled manually. In that case, d.h.w. heating will be shut down and the relays switched as follows:

- Actuator of primary return valve: no power supply, but can be manually controlled from the controller
- Other actuators: fully closed, no power supply
- Heating circuit pump: activated
- Charging pump and (if present) circulating pump: activated

Mechanical design

Controller

The RVD110 / 130 is comprised of controller insert and base.
The controller insert accommodates the electronics, the power section, the output relays and – on the front of the unit – the LCD and all operating elements.
Two screws are used to secure the controller insert to the base, which carries the connection terminals.
The RVD110 contains four relays, the RVD130 seven.
The controller can be mounted in three different ways:

- Wall mounting (on a wall, in a control panel, etc.)
- Rail mounting (on a standard DIN mounting rail)
- Flush panel mounting (compact station, control panel front, etc.)

Operation

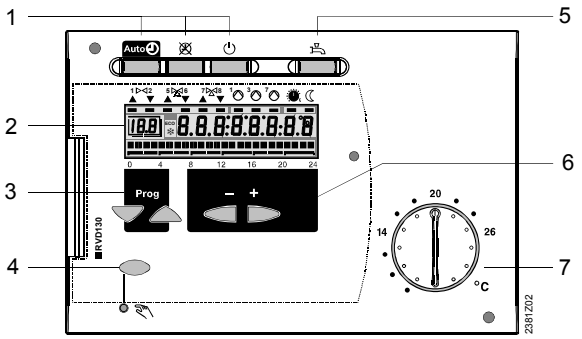
Analog operating elements

- Buttons for selecting the required operating mode and for d.h.w. ON / OFF
- Setting knob for the room temperature setpoint in continuous operation
- Button for manual operation

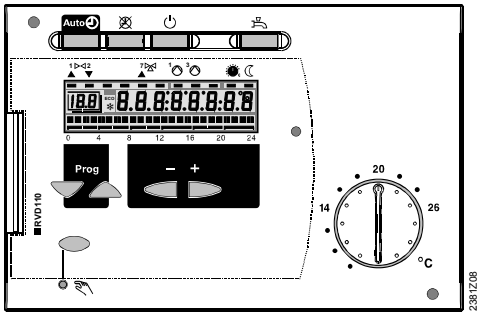
The entry or readjustment of all the other setting parameters, activation of optional functions, and reading of actual values and statuses is made using the operating line principle. An operating line with an associated number is assigned to each parameter,

each actual value and each function that can be selected. One pair of buttons is used to select an operating line and one pair to readjust the display.
These buttons are located behind a hinged cover. The operating instructions are inserted at the rear of the cover.

Display and operating elements



Front view of RVD130



Front view of RVD110

1 Buttons for selecting the operating mode
2 LCD
3 Buttons for selecting the operating lines
4 Button for manual operation ON / OFF
5 Button for d.h.w. heating ON / OFF
6 Buttons for readjustment of values
7 Setting knob for room temperature setpoint in continuous operation

Engineering notes

The wires of the measuring circuits carry extra low voltage
The wires to the actuator and the pumps carry AC 24...230 V
The local regulations for electrical installations must be complied with
Detector cables may not be run parallel to mains carrying cables for loads such as actuators and pumps
In control systems using a room temperature detector, the reference room may not be equipped with thermostatic radiator valves. Manual valves must be locked in their fully open position

Mounting notes

Suitable mounting locations are compact stations, control panels, control desks or the heating room. Not permitted are wet or damp locations
Mounting methods: wall, DIN mounting rail or panel cutout
All terminals for extra low voltage (detectors and room unit bus) are located in the upper section of the terminal compartment, those for mains voltage (actuators and pumps) in the lower section

Commissioning notes

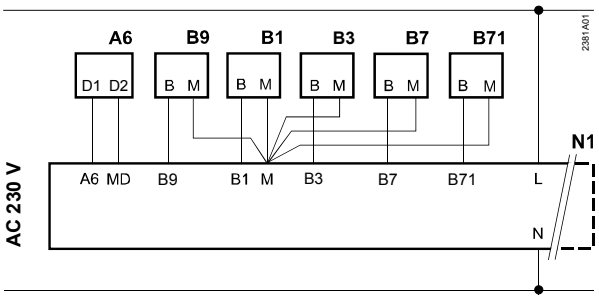
The plant type must be selected
The settings of the district heating parameters can be locked
The controller is supplied complete with mounting and commissioning instructions

Technical data

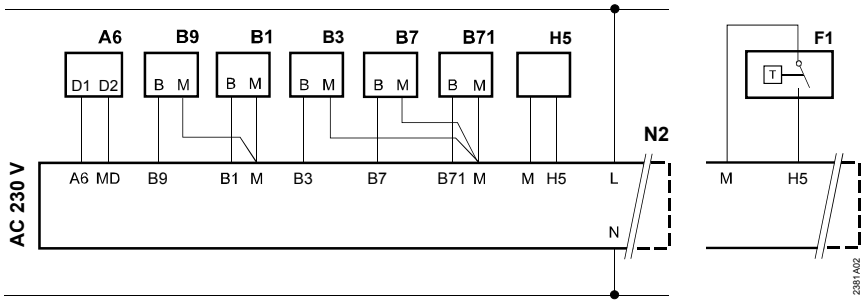
Power supply	Rated voltage	AC 230 V ±10 %
	Rated frequency	50 Hz
	Max. power consumption	8.5 VA, 6.5 W, cos φ >0.7
Functional data	Reserve of clock	12 h
Classifications to EN 60 730	Software class	A
	Mode of operation	type 1b (automatic controls)
	Degree of contamination	normal contamination
Detector inputs (B…)	Refer to chapter “Equipment combinations”	
Digital input (H5)	Low-voltage up to	U <10 V
	Switching current	I ≥2 mA (for reliable operation)
	Voltage with contact open	DC 12 V
	Voltage with contact closed	DC 2...5 mA
	Contact resistance	R ≤80 Ω
Switching outputs	Rated switching voltage	AC 24…230 V
	Rated current	
	Outputs Y1, Y2, Q1	AC 0.02…2(2) A
	Outputs Y5, Y6, Q3/Y7, Q7/Y8	AC 0.02…1(1) A
	Switch-on current	max. 10 A max. 1 s
	Max. rating as mixing valve relay	15 VA
Perm. cable lengths	To the detectors	
	Copper cable, 0.6 mm dia.	20 m
	Copper cable, 1.0 mm^2	80 m
	Copper cable, 1.5 mm^2	120 m
	To the room unit	
	Copper cable, 0.6 mm dia.	37 m
	Copper cable, ≥0.8 mm dia.	75 m
Degrees of protection	Degree of protection of housing to IEC 60 529	IP 40D
	Safety class to EN 60 730	II
Perm. environmental conditions	Transport	
	Temperature	–25…+70 °C
	Humidity	<95 % rH (noncondensing)
	Storage	
	Temperature	–5…+55 °C
	Humidity	<95 % rH (noncondensing)
	Operation	
	Temperature	0…+50 °C
	Humidity	<85 % rH (noncondensing)
Standards	CE conformity to EMC directive	89/336/EEC
	Immunity	EN 50082-2
	Emissions	EN 50081-1
	Low voltage directive	73/23/EEC
	Product safety	
	Automatic electrical controls for household and similar use	EN 60730-1
	Particular requirements for temperature sensing controls	EN 60730-2-9
	Special requirements for energy controllers	EN 60730-2-11
Weight	Net weight	0.77 kg

Connection diagrams

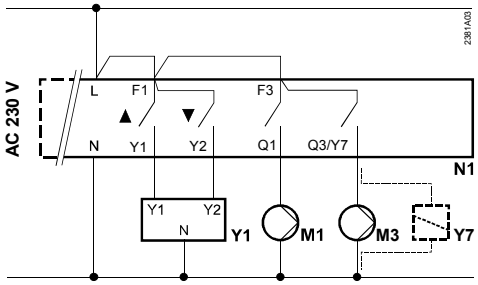
Low voltage side
RVD110



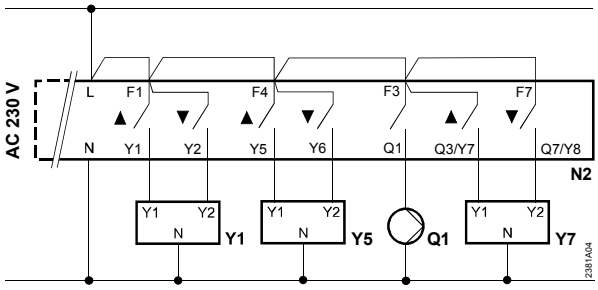
RVD130



Mains voltage side
RVD110

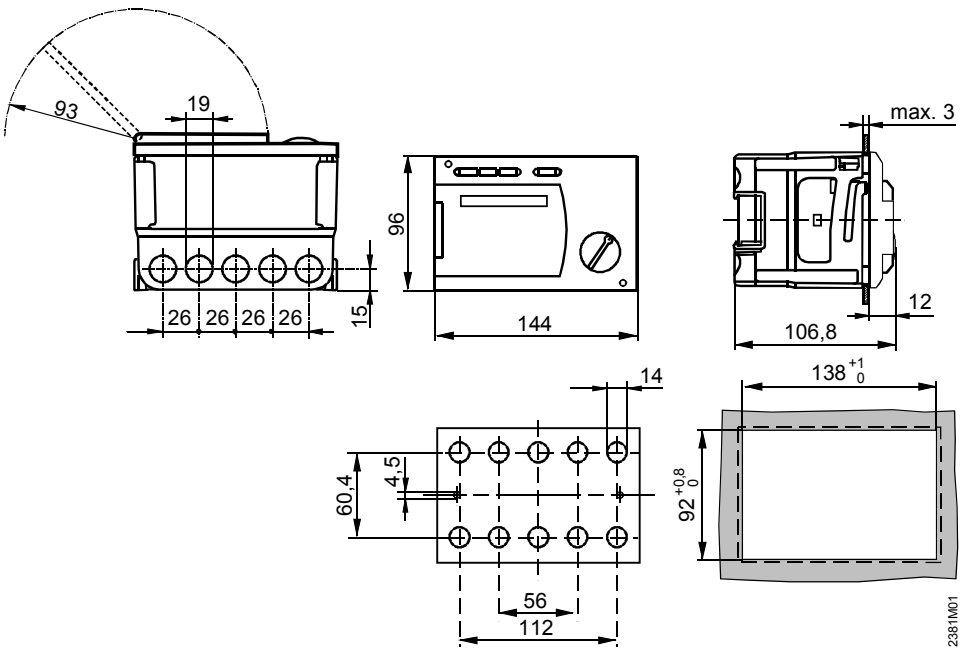


RVD130
Three actuators and one pump



A6 Room unit QAW50 or QAW70
B1 Flow temperature detector
B3 D.h.w. temperature detector
B7 Primary return temperature detector
B71 Universal detector according to plant type
B9 Outside detector
F1 D.h.w. thermostat
H5 Flow switch
N1 Controller RVD110
N2 Controller RVD130
Q1 Heating circuit pump
Q3 D.h.w. charging pump
Q7 D.h.w. circulating pump
Y1 Actuator of two-port valve in the primary return
Y5 Actuator of two-port valve in the d.h.w. circuit (plant type no. 4, 5, 6), or of mixing valve in the d.h.w. circuit (plant type no. 7), or of mixing valve in the heating circuit (plant type no. 8)
Y7 Actuator of changeover valve (plant type no. 3), or of mixing valve in the d.h.w. circuit (plant type no. 5)

Dimensions



Dimensions in mm