SIEMENS

Differential Temperature Controller RWD32S

Differential temperature controller for solar storage systems.
Panel mounting design. Two 2-position control outputs AC 24…230 V.

Use

Plant types
- Solar energy plants with one or two storage tanks
- Swimming pool heating systems with solar panels

Building types
- Residential buildings of all types
- Non-residential buildings of all types

Features
- Standalone electronic temperature controller
- Operating voltage AC 230 V
- Three inputs for LG-Ni 1000, Pt 1000 temperature sensors. Unit can be set as °C or °F
- One digital input for ON/OFF mode change-over
- Two 2-position outputs
- Entering or changing of all data via operating buttons on the controller, without additional tools
- PC connection for uploading / downloading applications and parameters, via the software tool (option)

Functions

Main functions
- Control of the adjusted temperature differential through 2-position outputs for one or two devices
- Pre-configured application types selectable
- Changeover to a secondary heat source upon demand (depending on application)
- Energy savings counter

Other functions
- Minimum charging temperature
- Absolute temperature setpoint
- Maximum tank temperature limitation
- Frost protection
- Gradient function
- Adjustable time delay for ON/OFF outputs

Ordering

When ordering, please give type reference:

Description, scope of delivery	Type reference
Temperature differential controller	**RWD32S**

Equipment combinations

Controlled devices

The following types of devices can be controlled:
- 2-position actuators
- On/Off actuating devices of all types

Controlled devices must have control contacts suited for AC 24…230 V, 4 A.

Temperature sensors

All types of temperature sensors using a sensing element LG-Ni 1000 Ω at 0 °C, or Pt 1000 can be used for the external signals (B1, B2 and B3). For example:

Type of sensor	Type reference	Data Sheet
Strap-on temperature sensor Ni 1000	**QAD22**	N1801
Immersion temperature sensor Ni 1000	**QAE2120..**	N1781
Solar panel sensor Ni 1000	**QAP21.2**	N1833
Cable temperature sensor Ni 1000	**QAP21.3**	N1831
Cable temperature sensor Pt 1000	**QAP2012.150**	N1831

All sensors connected to the controller must have the same sensing element type.

Accessories

Name	Type reference
Protective small enclosure for wall mounting	**ARG62.21**

Product documentation

| Document type	Classification number
Installation instructions	G3344
Declaration of Conformity (CE)	T3344
Environmental Declaration	E3344

Technical design

Basic Control

The controller switches its control output when the set temperature differential (setpoint) is reached.
The following settings are required:

- The setpoint, that is, the temperature differential required between the 2 plant components or sections
- The switching differential
- The switching delay

Two temperature sensors (B1, B2) are used to measure the heat source differential temperature.
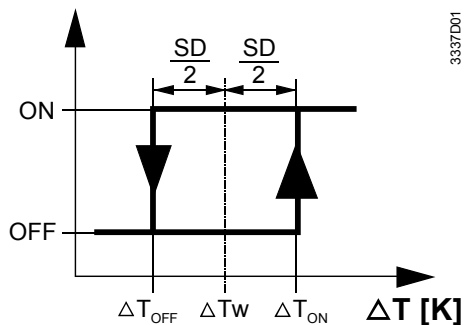
ΔT Differential temperature
ΔT_W Differential temperature setpoint
ΔT_{ON} Switch-ON point
ΔT_{OFF} Switch-OFF point
SD   Switching differential

If the source temperature (B2) *exceeds* the consumer temperature (B1) by the switch-ON point ($\Delta T_{ON} = \Delta T_W + \frac{1}{2}$ SD), the controller closes its control contact Q11–Q14, thus switching the actuating device ON. If this difference **falls below** the switch-OFF point ($\Delta T_{OFF} = \Delta T_W - \frac{1}{2}$ SD), the controller closes its control contact Q11–Q12, thus switching OFF the actuating device.

Minimum charging temperature

On the controller, a minimum charging temperature can be set.
The controller switches its control output only when the differential temperature setpoint (ΔT_W) **and** the minimum external temperature (B2) are reached. Below these temperature levels, the output is switched OFF with a fixed switching differential of 4 K.
When the limitation is active, the limit icon "LIM" is displayed on all screens and symbol "⌐" on B2 screen.
To disable this function, the parameter "**B2⌐**" must be set to value OFF (refer to document "Installation instructions").

Absolute setpoint temperature

With application types 2, 3 and 4, an absolute temperature can also be set.
- Application 2 : The controller switches its output ON (control contact Q21–Q24) when the temperature measured by sensor B3 falls below the value set. The output is switched OFF again (control contact Q21–Q22) when the temperature exceeds the setpoint by a switching differential of 1…10 K
- Application 3 and 4 : The controller switches its output ON (control contact Q21–Q24) when the temperature measured by sensor B3 exceeds the value set. The output is switched OFF again (control contact Q21–Q22) when the temperature falls down under the setpoint by a switching differential of 1…10 K

Maximum temperature limitation

A maximum temperature can also be set. When the temperature measured by sensor (B3 or B1) reaches the limit value set, the controller closes its control contact (Q11–Q12), thus switching the actuating device **off**. When this temperature falls below the setpoint by a fixed switching differential of 10 K, the controller closes its control contact (Q11–Q14) and the actuating device is switched back ON again.
When the limitation is active, the limit icon "LIM" is displayed on all screens and symbol "Γ" on B3 or B1 screen.
To disable this function, the parameter "Maximum charging temperature" must be set to value OFF (refer to document "Installation instructions").

Frost protection

If the temperature of the solar collector (B2) drops below 5 °C, the pump is switched on and the icon "Fr" is displayed, blinking on all screens. When collector temperature drops above 10 °C, the pump is switched off.
To disable this function, the parameter "FROST" must be set to value OFF (refer to document "Installation instructions").

Gradient function

The pump must periodically be switched on, as the temperature at the collector (primarily vacuum pipes) cannot be measured reliably when the pump is off.
If pump is not switched on during more than 30 minutes or "OFF mode" activated, the controller switches on the pump during 30 seconds every 30 minutes.
To disable this function, the parameter "GRAD" must be set to value OFF (refer to document "Installation instructions").

Energy saving counter

The controller displays the cumulated energy savings done by the plant since first start or last counter reset. Calculated cost saving value (local currency not displayed) is based on parameters set during commissioning by customer:

- Pump flow rate (m^3/h) indicated on pump plate
- Cost (local currency / kWh) of energy chosen as reference (i.e. gas, electricity)

OFF Mode

When "OFF mode" is activated with an external command as time switch or manual switch, on dedicated controller input (D1–GND), the internal control loop is disabled.
As long as this mode is activated, only minimal functions remain active (Frost protection and gradient function).

⚠ During "OFF Mode", pump can be switched on by controller functions as "Frost protection" or "Gradient function". These functions can be disabled if necessary (refer to document "Installation instructions").

Mechanical design

Housing

The controller is designed for mounting in a wall or a cabinet.
The product set RWD32S is as per DIN 43 880 Gr. 1 requirements.

The housing is made of plastic and accommodates the controller electronics and all operating elements, which are accessible into the front of the controller. The front carries three buttons and an LCD display.

Protective housings ARG62.21

A protective housing is used to protect the controller when mounted outside a control panel, such as on ducts, walls and in plant rooms. Furthermore, the protective housing prevents inadvertent contact with voltage supplying parts such as the connecting terminals.
The RWD32S controller clips on a DIN rail into the protective housing. Cable entries are located at the top and the bottom of the protective housing. Front has an opening for the LCD display and the programming buttons.

Operating and display elements

The RWD32S is operated by the buttons on the controller front. Additional tools are not necessary. A 9-pin port is provided for optional programming via the software tool.
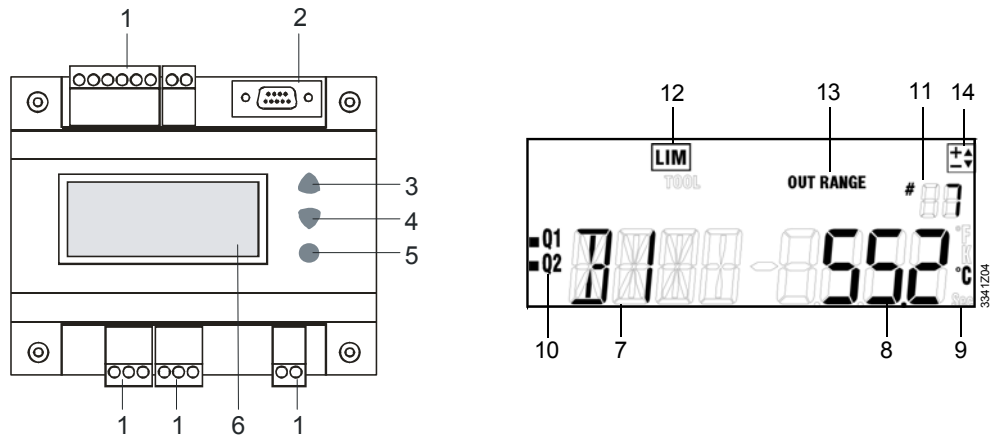
1 Plug-in screw terminals
2 9-pin port for optional software tool
3 Operating button, upward (+) for viewing and adjusting parameters
4 Operating button, downward (–) for viewing and adjusting parameters
5 Select button to enter or save the value adjustment
6 Display
7 Sensor input or parameter
8 Value
9 Units
10 Relay outputs status
11 Application number (e.g. #1) or frost protection function ("Fr" blinking)
12 Limit icon displayed when limitation functions are actives (tank or solar panel temperature reached one of limits defined by user)
13 Alarm message for sensor value
14 Setting icon displayed when the parameter can be modified

LCD display

The LCD display shows the following information during normal operation:

- Current temperature values
- Current outputs status
- Differential temperature setpoint
- Application number
- Energy savings counter value

Configuration

Seven standard application types are preset into the controller. The respective mode is defined by entering the corresponding application number via the push buttons on the controller or the software tool.

All applications (1…7) contain the basic differential temperature control loop described. To configure the controller, follow the instructions supplied with the controller.

Engineering notes

Intended use

Use this controller only for applications as described on the title page (bold print) and the section "Use". Additionally, observe all conditions and restrictions imposed in this section and in "Technical data".

⚠ The sections marked with a warning symbol contain technical safety requirements and restrictions. Observe all of these warnings as they directly relate to the protection of person and equipment.

Installation notes

Mounting

Controller is designed for:

- Mounting in a standard cabinet to DIN 43880 Gr. 1 requirements
- Wall mounting on an existing top hat rail (to EN 60715-TH35-7.5)
- Wall mounting with 2 fixing screws

A   B   C   D
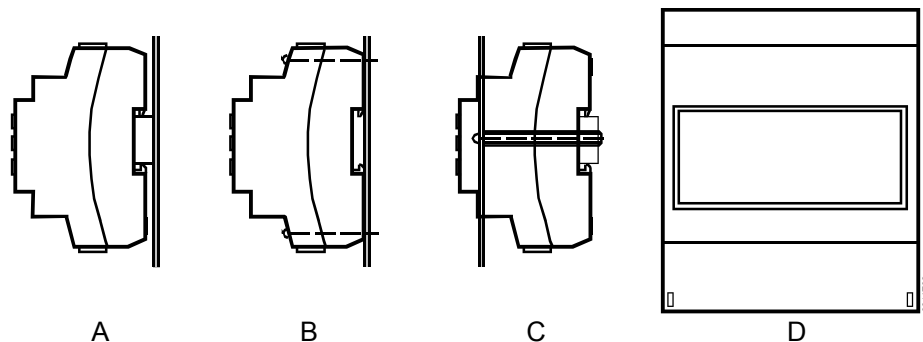
A On a DIN rail (EN 50 022-35 × 7.5) at least 120 mm long
B Wall mounted with 2 screws
C Front mounted using standard elements, e.g. 1 DIN rail 150 mm long, 2 hexagonal
   placeholders 50 mm, washers and screws
D In the ARG62.21 protective housing

- Not permitted are wet or damp spaces. The permissible environmental conditions
  must be observed
- The system must be disconnected from the power supply prior to mount the controller
- Each terminal can accommodate only 1 solid wire or 1 stranded wire. For making the
  connections, the cables must be stripped for 7 to 8 mm
- Observe all local installation and mounting regulations
- The controller is supplied complete with Installation instructions, including Operating
  Instructions

Electrical installation

Standard cables can be used for the controller. However, when mounting in an envi-
ronment greatly exposed to EMI, use only shielded cables.

The RWD32S is designed for AC 230 V operating voltage.

Commissioning notes

A booklet is supplied with the controller for commissioning.
Observe the following:
- The controller must be configured for plant-specific operation using standard
  application number
- Plant specific fine tuning can be performed if required (refer to the commissioning
  booklet)
- Power supply to the controller and the connected devices must be guaranteed
- Values and settings entered remain available even on power failure

Technical data

Power supply	Operating voltage	AC 230 V +10%, 15%
	Frequency	50 / 60 Hz
	Power consumption	6 VA

Analog inputs B1, B2, B3	LG-Ni 1000	
	Controller Measuring Range	−50…+150 °C
	Max. cable length for dia. 0.6 mm	Max. 300 m
	Pt 1000	
	Controller Measuring Range	−20…+180 °C
	Max. cable length for dia. 0.6 mm	max. 300 m

Digital input D1	Polling voltage for control commands (D–M)	DC 15 V
	Current consumption	<15 mA

6/12

Digital outputs Q1, Q2	Relay contacts (potential-free)	
	Voltage	AC 24...230 V
	Maximum rating	AC 230 V, 4 A resistive, 3 A ind. (per relay terminal)
		DC 30 V, 4 A
	Minimum rating	AC 19.2 V, 20 mA
		DC 5 V, 100 mA
	Delay time	0…900 sec.

Display	Screen	LCD
	Number of digits	4
	Resolution (these values do not relate to the controller accuracy)	
	LG-Ni 1000	0.1 °C
	Pt 1000	0.1 °C

Functional data	Setting ranges	
	Setpoint temperature differential	0…40 K
	Mminimum charging temperature	OFF, 30…90 °C
	Absolute temperature	30…90 °C
	Maximum temperature	OFF, 30…130 °C
	Switching differentials	
	Main ΔT control loop	2…20 K
	Absolute temperature	1...10 K
	Minimum temperature	fixed (4 K)
	Maximum temperature	fixed (10 K)
	Frost protection	fixed (5 K)

Environmental conditions	Transport	IEC 60721-3-2
	Climatic conditions	Class 2K3
	Temperature	−25...+70 °C
	Humidity	<95 % r.h.
	Mechanical conditions	Class 2M2

|		
Norms and standards	Operation	IEC60721-3-3
	Climatic conditions	Class 3K5
	Temperature	0...+50 °C
	Humidity	<95 % r.h.
	CE conformity according to	
	EMC directives	2004/108/EC
	Low voltage directive	2006/95/EC
	Product standards	
	Automatic electrical controls for household and similar use	EN 60 730-1 and EN 60 730-2-11
	Electromagnetic compatibility	EN 60730-1 A16
	Emissions and immunity	Residential and industrial environments
	Protection degree	
	Controller RWD32S	IP 20 as per EN 60529
	Controller with housing ARG62…	IP 30 as per EN 60529
	Other international approval	N474
	Safety class	Automatic electrical controls for household and similar use, EN 60 730
	Degree of contamination	Normal

General

	Connection terminals for solid wires or stranded wires	min. 0.5 mm dia. max. 2 × 1.5 mm^2 or 2.5 mm^2
	Weight	0.343 kg

Connection terminals
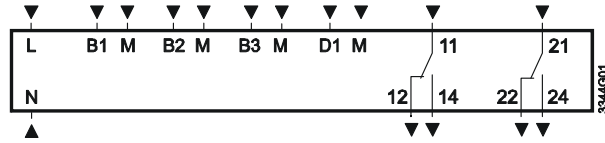
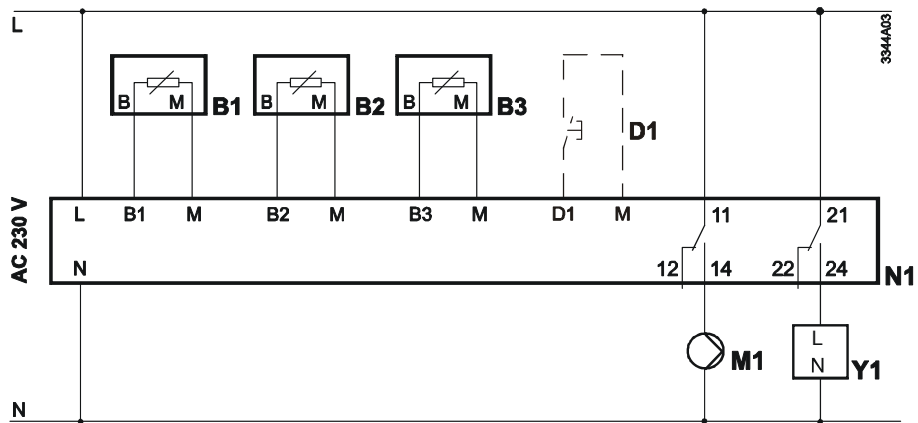|	
L, N	Operating voltage AC 230 V
B1, B2, B3	Temperature sensors inputs
M	Measurement neutral
D1	ON/OFF input
GND	Input neutral
11-12-14	Relay output Q1
21-22-24	Relay output Q2

Connection diagrams
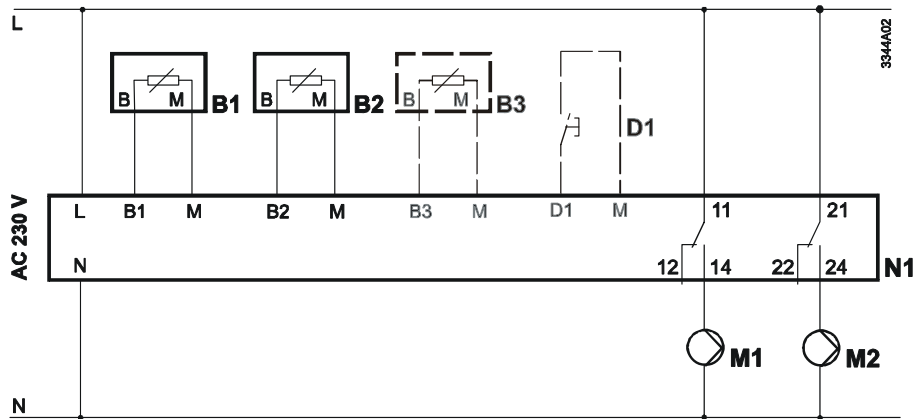
Differential temperature controller with 2 external temperature sensors. Control of a charging pump and boiler pump (e.g. application 2)

Differential temperature controller with 3 external temperature sensors. Control of a charging pump and a 2-position actuator (e.g. application 3)

|	
N1	Differential temperature controller RWD32S
B1	Storage tank temperature sensor
B2	Solar panel collector temperature sensor
B3	Additional temperature sensor for absolute control loop
D1	External ON/OFF mode changeover
M1	Charging pump
M2	Boiler pump
Y1	Actuator for changeover valve

Application 1
Standard Solar System
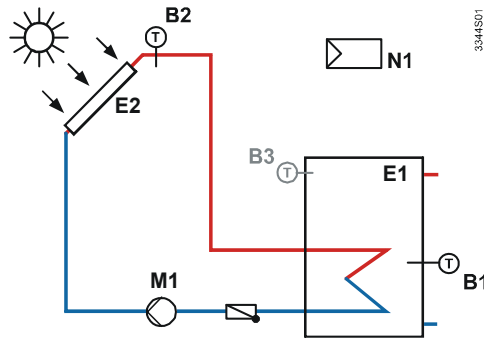
Basic differential temperature control of a storage tank. The temperature difference between the solar collector (measured by sensor B2) and the storage tank temperature sensor (B1) is compared with the Δt setpoint.
The charging pump M1 is activated when the set differential + half of switching differential is reached.

Application 2
Solar System with
Additional Heat Producer
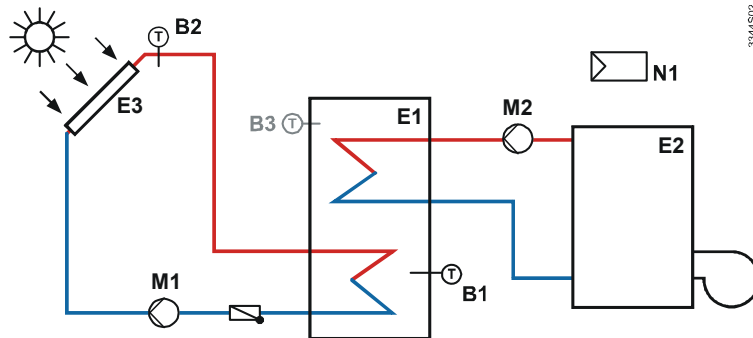
Differential temperature control of a storage tank with changeover to a separate heat producer (typically a boiler or electrical heater) when the solar energy is not sufficient. The charging pump M2 is activated to maintain a fixed temperature in the tank with specific temperature differential for pump M2.
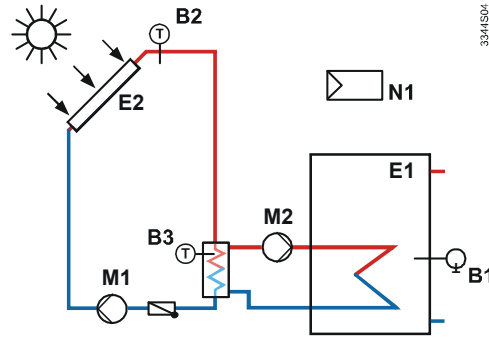
Application 3
Solar System with
Diverting Valve (Bypass)
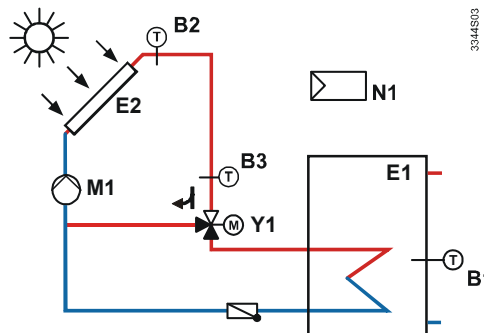
Differential temperature control of a storage tank with an additional sensor (B3) in the flow from the collector and a bypass valve (Y1).
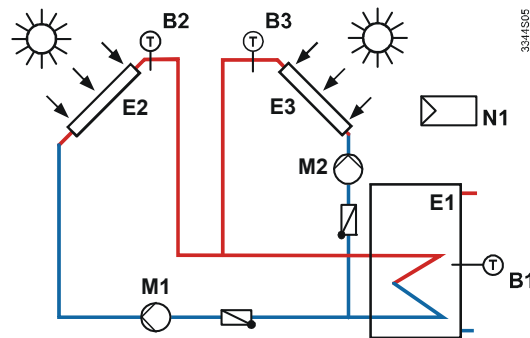This application is used :

- where the collector is a long way from the storage tank (e.g. on a high roof) and prevents cool water in the pipe work from being fed into the tank (typically on morning start up or after long periods without solar energy).
- when frost protection is important regarding external temperature

Application 4

Solar System with
Heat Exchanger (Buffer)

Differential temperature control of a storage tank with an additional buffer tank or heat exchanger used between the solar collector and main storage tank.

An additional sensor (B3) measures the temperature in the heat exchanger, and the storage tank is only charged when the exchanger temperature reaches the required setpoint.

Application 5

Solar System with
2 Collectors (East/West)

Differential temperature control of a storage tank by two independent solar collectors (e.g. east and west facing).

This application is used in very sunny areas to maximize the solar energy throughout the day.

Application 6

Solar System with layered
Storage Tank (2 heat exchangers)
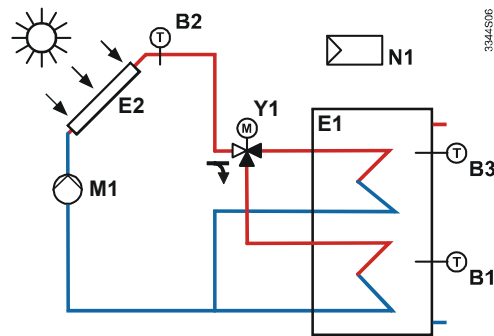
Differential temperature control of a layered storage tank. During periods of low solar energy this application maximizes the heat available by charging the lower part of the storage tank only. As the solar energy increases, the bypass valve (Y1) closes and the upper part of the tank is charged.

Application 7

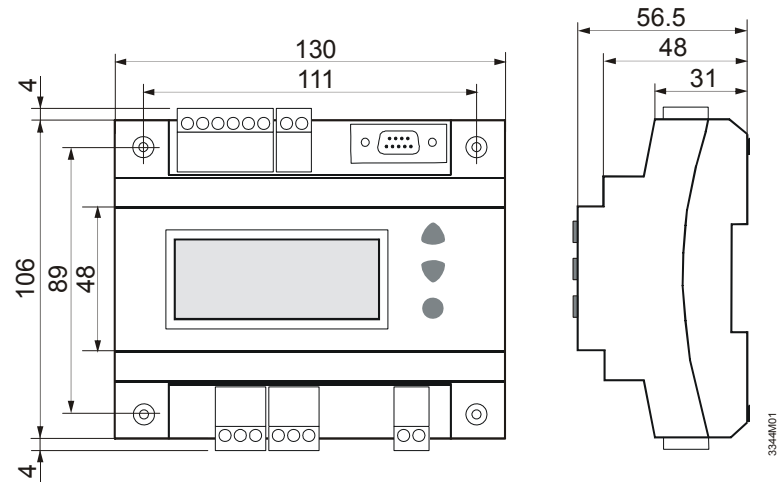Solar System with 2 Storage
Tanks and 1 Collector
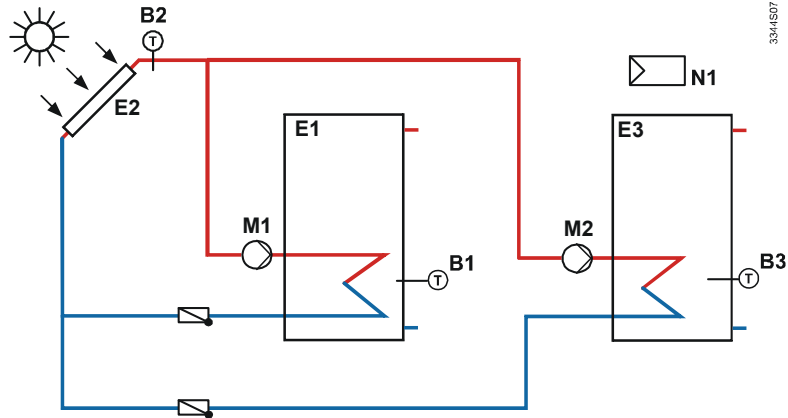
This application uses a single solar collector to charge two storage tanks or other applications (e.g. swimming pool).

Tank 2 (E3) is only charged if first tank (E1) reached maximum temperature limit. It is typically used where the sun's energy is very high and for long periods. The second heating storage avoid to reach a too high temperature in solar panel.
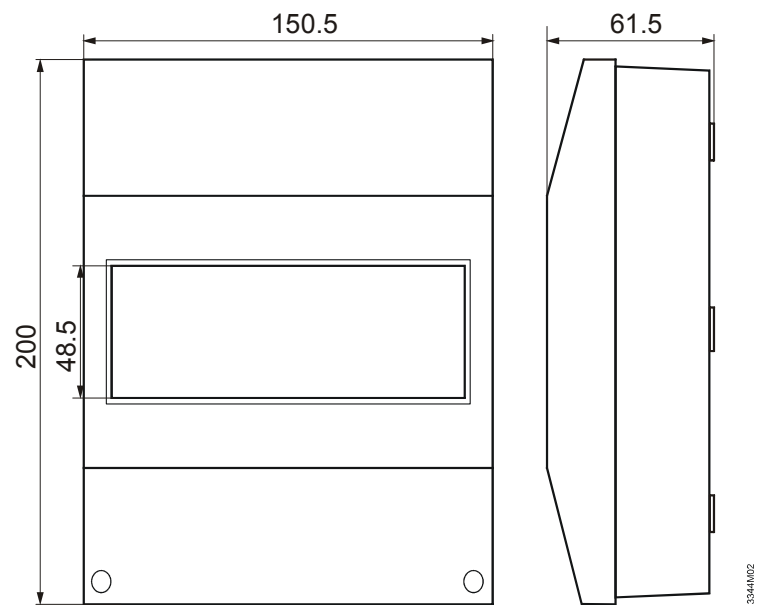
B1   Heat consumer temperature sensor (storage tank)
B2   External temperature sensor (heat source)
B3   Auxiliary temperature sensor
E1   Heat consumer (storage tank)
E2   Primary heat source (solar collector)
E3   Secondary heat source (boiler, electric immersion heater) or additional solar collector
M1   Charging pump 1
M2   Charging pump 2
Y1   Actuator for changeover/bypass valve

Dimensions

RWD32S

ARG62.21

Dimensions in mm

Siemens
Building Technologies

Differential Temperature Controller RWD32S

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