# SIEMENS

**2²¹⁷**



## Self-learning room temperature controller

## REA23M

Boiler control with OpenTherm Plus interface

- **Straightforward, self-explanatory menu selection via setting knob**
- **Permanent self-learning, adaptive control providing PID mode**
- **Choice of operating modes:**
  **Automatic with maximum 3 heating periods, continuous comfort mode, continuous economy mode, frost protection with one 24-hour operating mode with one heating period**
- **In automatic mode, one temperature setpoint can be adjusted for each heating period**

**Use**

In combination with Boiler Management Units (BMU) or heating controllers with OpenTherm Plus interface. For the control of the room temperature in:

- Apartments, single-family or 2-family houses
- Smaller multifamily houses
- Holiday houses and villas

Application

For use in all standard heating systems, such as radiator or convector heating systems. Especially suited for heating plants with pump heating circuits. If the boiler control systems feature integrated mixing valve control, it is also possible to control mixing heating circuits.

**Functions**

- Delivery of the flow temperature setpoint
- Pure room temperature control
- Permanent self-learning PID control for normal and fast control loops
- 2-position control for difficult controlled systems
- Automatic mode with 7-day switching program for 24-hour, working day, weekend or 7-day operation with up to 3 heating periods per day
  (4th priority for actual valid temperature setpoint)
- Integrated 7-day time switch
- One temperature setpoint for each heating period
- One 24-hour operating mode with one heating period
- Remote operation (1st priority for actual valid temperature setpoint)
- Override button (3rd priority for actual valid temperature setpoint)
- Sensor calibration and reset function
- Frost protection function
- Limitation of the minimum setpoint
- Holiday mode (2nd priority for actual valid temperature setpoint)
- Optimum start control for the first heating period
- If provided by the boiler, alternating display of: relative modulation level, flow temperature, outside temperature and DHW setpoint
- If provided by the boiler, display of error code in case of error
- Transmitting of actual operating mode to a Siemens boiler management unit
  (refer to user guide of boiler management unit)

**Ordering**

Room temperature controller with 7-day time switch                    **REA23M**

When ordering, please give the type reference.
The controller is supplied complete with batteries.
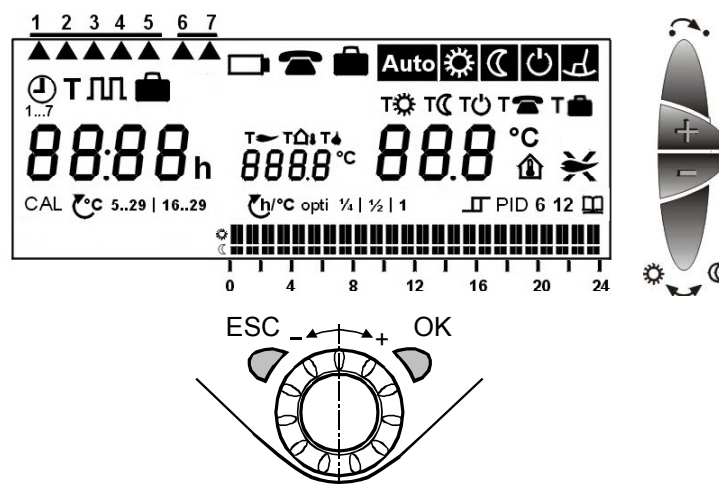
**Technical design**

**Communication**

The OpenTherm bus is used for communication between room temperature controller and boiler control. The REA23M can only be used in combination with an OpenTherm Plus boiler.
**OpenTherm Plus** affords reading and writing of several compatible standard objects between room temperature controller and boiler control via the bus.
Immediately after installation, the room temperature controller examines if the connected BMU supports the OpenTherm Plus protocol. If OpenTherm Plus is not supported, error message ✖ will be displayed.
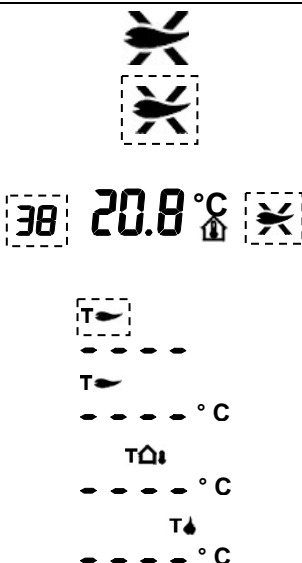
Display and
operating elements

## Operating elements

| | | |
|---|---|---|
| | (symbol) | **Selection of operating mode**<br>(4<sup>th</sup> priority for actual valid temperature setpoint) |
| | **+** | **Warmer button** |
| | **–** | **Colder button** |
| | ☀ ☽ | **Override button**<br>(3<sup>rd</sup> priority for actual valid temperature setpoint) |
| | **ESC** | **Leaving the current menu level and returning to the previously active menu level** (the settings currently displayed will be accepted) |
| | (rotary knob) | **The rotary knob is only operable within the menus.**<br>**Move from menu to menu, modify adjustable variables** (temperature in increments of 0.2°C and time in hours and minutes) **and select functions.** |
| | **OK** | **Access the menus, enable a menu, save inputs, switch to the next menu option and acknowledge with the OK button.** |

## Normal display

| | | |
|---|---|---|
| **21:38h** | **Time of day** | |
| **20.8 °C** | **Room temperature** | |
| **T 38.0** | **Relative modulation level in %** | **Alternating display / alternates each few seconds** |
| **T 38.0 °C** | **Flow temperature** | (If provided by the boiler, automatic display of these data. Display can not be suppressed manually.) |
| **T 18.0 °C** | **Outside temperature** | |
| **T 60.0 °C** | **DHW temperature setpoint** | |
| (battery symbol) | **Change batteries (display appears about 3 months before batteries are exhausted)** | |
| (telephone symbol) | **Remote control active**<br>(1<sup>st</sup> priority for actual valid temperature setpoint) | |
| (suitcase symbol) | **Holiday mode active**<br>(2<sup>nd</sup> priority for actual valid temperature setpoint) | |
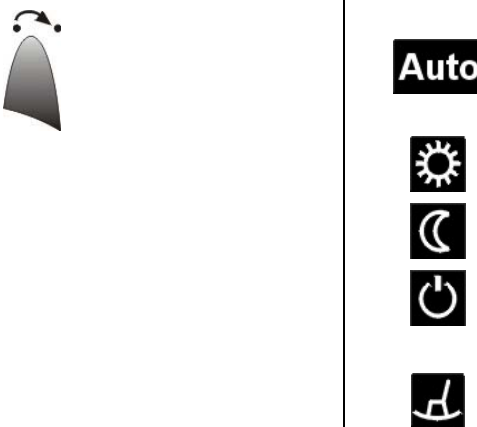
**Error display**

| | | |
|---|---|---|
| | **Permanent display:** | **Communication with BMU incorrect or REA23M is not placed on its base.** |
| | **Flashing display:** | **BMU reports an error** |
| 38 20.8 °C ✖ | **Flashing display:** | **BMU reports an error and writes its error code on display.** (automatic display, can not be suppressed manually) |
| T◢ – – – – | **Error in transmission of relative modulation level** | |
| T◢ – – – – °C | **Error in transmission of flow temperature or sensing element for flow temperature defect** | |
| T⌂↕ – – – – °C | **Error in transmission of outside temperature or sensing element for flow temperature defect** | |
| T◊ – – – – °C | **Error in transmission of D.H.W. setpoint** | |
| | **Error is being displayed latest 2 minutes after error occurs.** | |

**Selection of operating mode (only one operating mode is active)**
(4th priority for actual valid temperature setpoint)

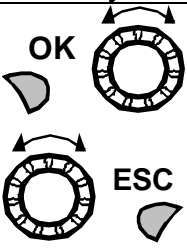| | | |
|---|---|---|
| | **Auto** | **Automatic mode** |
| | ☀ | **Comfort mode** |
| | ☾ | **Economy mode** |
| | ⏻ | **Frost protection** |
| | | **24-hour mode with one heating period** (heating period is automatically generated from the current 24-hour program) |

**Temporary change of the current setpoint temperature**
**(change only active until the next switching point is reached)**
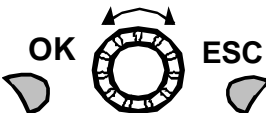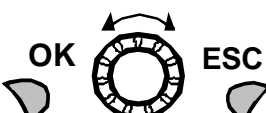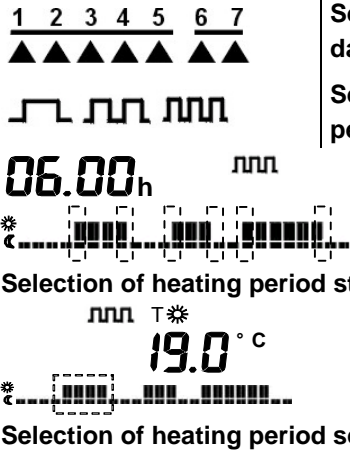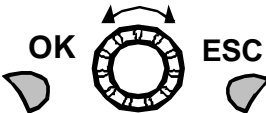
| | | |
|---|---|---|
| + – | **19.0** °C | **When pressing the + or – button once, the adjusted setpoint temperature will be displayed. It can be readjusted in increments of 0.2 °C (max. +/- 4 °C).** |

**Override button**

In operating modes **Auto** and ⬥, this button can be used to switch from comfort to economy temperature, or vice versa. The selection is maintained until the next switching point is reached or until the operating mode is changed.
(3rd priority for actual valid temperature setpoint)

## Menu-driven user settings: 4 main menus available

| Time of day and day | Main menu | Submenu | Settings | |
|---|---|---|---|---|
| OK ⟳ ESC | 🕐 1...7 | **12:00**h | Current time of day | |
| | | 1 2 3 4 5 6 7 ▲ | Current day of week | |

| Temperature | Main menu | Submenu | Factory settings | |
|---|---|---|---|---|
| OK ⟳ ESC | T | T☼ | Setpoint comfort mode | 19 °C |
| | | T☾ | Setpoint economy mode | 16 °C |
| | | T⏻ | Setpoint frost protection | 5 °C |
| | | T☎ | Setpoint economy mode remote operation | 10 °C |

| Time switch | Main menu | Submenu | Settings |
|---|---|---|---|
| OK ⟳ ESC | ⊓⊓ | 1 2 3 4 5 6 7 ▲ ▲ ▲ ▲ ▲ ▲ ▲ | Selection of day of week, working day, weekend or week |
| | | ⊓ ⊓⊓ ⊓⊓⊓ | Selection of the number of heating periods, max. 3 |
| | | **06.00**h ⊓⊓⊓ | Selection of heating period start and end time |
| | | ⊓⊓⊓ T☼ **19.0** °C | Selection of heating period setpoint temperature |

| Absence | Main menu | Submenu | |
|---|---|---|---|
| OK ⟳ ESC | 💼 | T💼 | Entry of holidays or periods of absence. (Number of days with economy mode setting / max. 99 days) Temperature setpoint during absence Factory setting 12 °C |

| Menu-driven heating engineer settings | Main menu | Settings |
|---|---|---|
| ![+/- buttons] | **CAL** | **Sensor calibration** |
| ![OK ESC dial] | °C 5..29 \| 16..29 | **Setpoint limitation** |
| | ↻h/°C opti ¼ \| ½ \| 1 | **Optimum start control for the first heating period (in unit of time per 1 °C)** |
| | ⊓ | **2-position control** |
| | PID ▥ | **PID mode, permanent-self-learning** |
| | PID 6 \| 12 | **PID6 mode for fast and PID12 mode for normal controlled systems** |
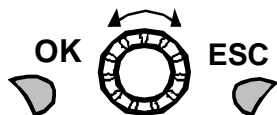
**Temperature setpoints**

In automatic operating modes, temperature setpoints can be individually adjusted for every comfort period and for the continuous operating modes. The temperature setpoint of economy mode is the same in automatic and continuous operation.

**Protective function**

In the frost protection mode, the room temperature is constantly monitored. If it falls below the adjusted setpoint, heating is switched on to maintain the adjusted frost protection setpoint temperature T⏻.

**24-hour operating mode**

The controller generates the 24-hour operating mode from the current 24-hour program. It automatically selects the switch-on time of the first heating period and the switch-off time of the last heating period to generate and display a complete heating period. The comfort temperature used by the controller is the currently stored standard setpoint of the continuous operating mode ☼. The self-generated 24-hour operating mode is maintained until another operating mode is selected.

Example



| Automatically generated 24-hour operating mode | Current 24-hour switching program when 24-hour operating mode is activated |
|---|---|
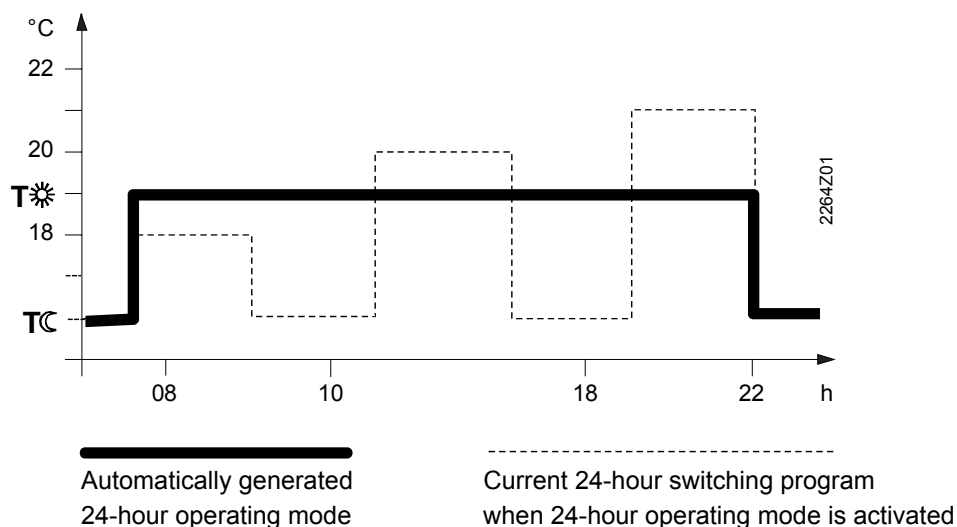
**Switching program**
ЛЛ

The switching program can be used as a 7-day or 24-hour switching program, depending on programming. It is also possible to select one of the continuous operating modes ☼ ☾ ⏻ with which the switching program is not used.

With the 7-day switching program, it is possible to program all days individually, the working days (1-5), the weekend (6-7), or the entire week (1-7).

When a heating period is programmed, 3 different switching patterns are available.

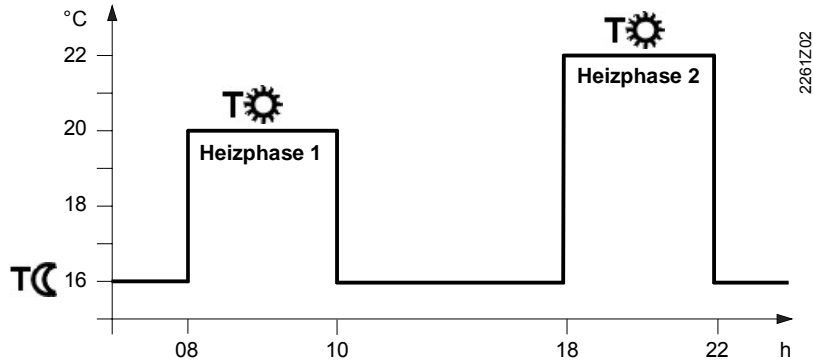It is possible to select 1, 2 or 3 heating periods. For each heating period, the start time, end time and comfort setpoint are to be entered. In between heating periods, it is always the same economy temperature setpoint that is used. This economy temperature setpoint can be adjusted on the temperature menu.

Example with 2 heating periods per day



**Holiday function**
🧳

The holiday function is to be selected on the user menu. Set the start of the holiday period (day of departure/ $\overset{1\ 2\ 3\ 4\ 5}{\blacktriangle\blacktriangle\blacktriangle\blacktriangle\blacktriangle}\ \overset{6\ 7}{\blacktriangle\blacktriangle}$ / day of week), the duration and the temperature setpoint (T🧳) during your absence. This will enable the controller to maintain the required temperature for a period of up to 99 days. Every midnight, the counter subtracts one day.

When the holiday period is over and the counter reads 00, the controller will resume the operating mode selected last.

(2nd priority for actual valid temperature setpoint)

**Remote operation**
☎

Using a suitable remote operator unit, the controller can be switched to an independently adjustable economy temperature T☎. Changeover is accomplished by the making of a potential free contact connected to terminals T1 and T2. In that case, symbol ☎ will appear on the display. When the contact opens, the operating mode selected last will be resumed.

(1st priority for actual valid temperature setpoint)

| Operation according to the setting made on the controller | Continuous remote operation economy temperature |
|---|---|
|  |  |

Remote operating devices

Suitable remote operator units:
Telephone modem, manual switch, window switch, occupancy detector, central unit, etc.

**Transmission of actual operating mode to Siemens boiler management unit**

When REA23M recognizes a connected boiler management unit **_LMU33, LMU36, LMU54, LMU55, LMU64, LMU65_** from Siemens (refer to user guide), the actual operating mode of the REA23M is being transmitted to the boiler management unit. Connecting other Siemens boiler management units or boiler management units from other manufacturers, the actual operating mode of the REA23M is not being transmitted. This procedure runs automatically. It can neither being influenced manually nor being switched off.

Following data of actual operating mode is being transmitted to the boiler management unit by ID129:

REA23M  Frost protection  (active in operating mode „Frost protection")

Reduced  (active in operating modes "continuous economy mode", "holiday mode", with active remote control and during economy periods in operating modes "Auto" and "24-hour operating mode with one heating period")

Nominal  (active in operating mode "continuous comfort mode" and during comfort phases in operating modes "Auto" and „24-hour operating mode with one heating period")

Quick setback  (active when adjusting a lower temperature setpoint, e.g. changing operating mode from "continuous comfort mode" to "continuous economy mode")

Factory settings

| Oper-ating mode | Block / week-days | Switching times | | | | | | Temperatures in °C | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ☀☾ | | | | | | T☀ 1st period ⧼ | T☀ 2nd period ⧼ | T☀ 3rd period ⧼ | T☾ ⧼ | T⏻ ⧼ | T☎ ⧼ | T🧳 ⧼ |
| | | 1st period | | 2nd period | | 3rd period | | | | | | | | |
| **Auto** | 1-5 Mo-Fr | 06.00 | 08.00 | 11.00 | 13.00 | 17.00 | 22.00 | 19 | 20 | 21 | 16 | | | |
| | 6-7 Sa-Su | 07.00 | 23.00 | | | | | 19 | | | 16 | | | |
| ☀ | 1-7 Mo-Su | 00.00 | 24.00 | | | | | 19 | | | | | | |
| ☾ | 1-7 Mo-Su | 00.00 | 24.00 | | | | | | | | 16 | | | |
| ⏻ | 1-7 Mo-Su | 00.00 | 24.00 | | | | | | | | | 5 | | |
| ☎ | | | | | | | | | | | | | 10 | |
| 🧳 | Absence | | | | | | | | | | | | | 12 |

Factory settings heating engineer level

Setpoint limitation    ⌒°C 5..29

Optimum start control    ⌒h/°C opti **(OFF)**

Temperature control:    PID 📖    (permanent self-learning)

8/14

Building Technologies
HVAC Products

Room temperature controller REA23M

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**Access**

The heating engineer level will be enabled by pressing simultaneously the warmer and colder buttons and by turning the setting knob counter-clockwise and then clockwise.

**Sensor calibration**

**CAL**

If the displayed temperature does not agree with the effective room temperature, the temperature sensor can be recalibrated (recalibration to be made on the heating engineer menu).
The displayed temperature can be matched to the effective room temperature in increments of 0.2 °C (max. ±2 °C).

**Limitation of setpoint**
**°C 5..29 | 16..29**

Minimum setpoint limitation of 16 °C prevents undesired heat transfer to neighboring apartments in buildings with several heating zones. The setting is to be made on the heating engineer menu.
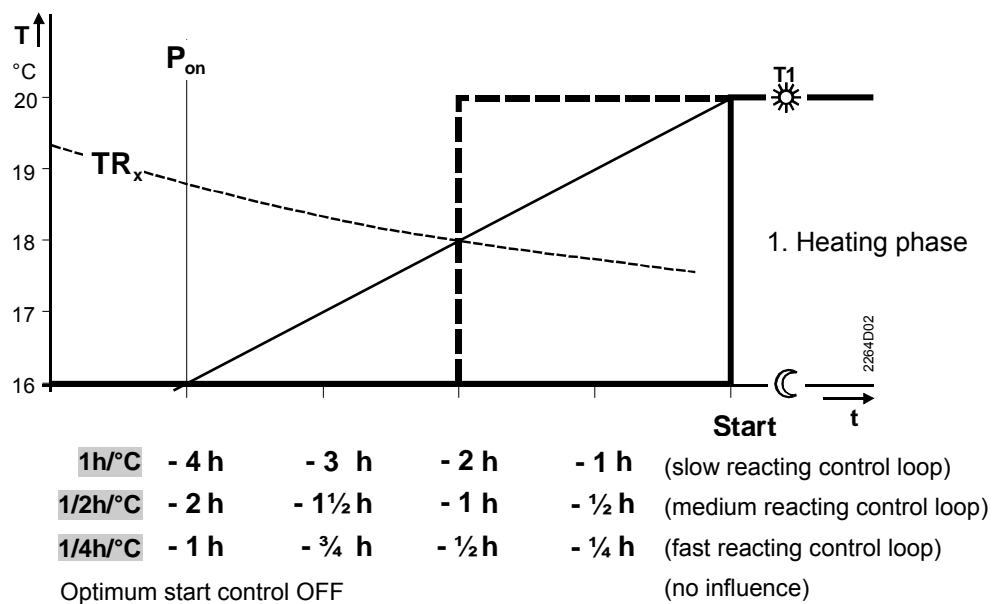
**Optimum start control**
**h/°C opti ¼....**

Optimization brings forward the switch-on point of the first heating period such that the adjusted setpoint will be reached at the desired time.
The setting depends on the type of controlled system, that is, on heat transmission (type of piping system, radiators), building dynamics (building mass, insulation), and heat output (boiler capacity, flow temperature).

Optimum start control is switched off at **h/°C opti**

Example with an actual room temperature of 18 °C and a setpoint of 20 °C:



| | | | | |
|---|---|---|---|---|
| **1h/°C** | **- 4 h** | **- 3 h** | **- 2 h** | **- 1 h** | (slow reacting control loop) |
| **1/2h/°C** | **- 2 h** | **- 1½ h** | **- 1 h** | **- ½ h** | (medium reacting control loop) |
| **1/4h/°C** | **- 1 h** | **- ¾ h** | **- ½ h** | **- ¼ h** | (fast reacting control loop) |
| Optimum start control OFF | | | | | (no influence) |

| | | | |
|---|---|---|---|
| T | Temperature (°C) | $TR_x$ | Actual value of room temperature |
| t | Forward shift of switch-on point (h) | $P_{on}$ | Starting point of optimum start control |

**Control**

The REA23M is a communicating controller providing PID mode.
The control (boiler and REA23M) delivers the necessary flow temperature depending on the deviation of the adjustable setpoint from the actual value acquired by the built-in temperature sensor.

The rate of response to the deviation depends on the selected control algorithm:

**Permanent-self-learning operating mode**

**PID**

By default (factory setting) the controller operates in self-learning operating mode, whereby it automatically adapts to the controlled system (type of building construction, heating capacity, type of heaters, room size etc.). After a learning period, the controller self-optimizes the parameters and then operates in accordance with the newly learned parameters.

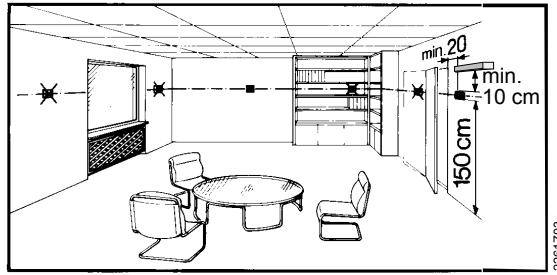| | |
|---|---|
| Exceptions | In exceptional cases, in which the permanent-self-learning mode may not be ideal, PID 12, PID 6 or 2-Pt mode can be selected: |
| **PID 12** | PID 12 mode     For normal or slow controlled systems (massive building structures, large spaces, cast-iron radiators, oil burners). |
| **PID 6** | PID 6 mode     For fast controlled systems (light building structures, small spaces, plate radiators or convectors, gas burners). |
| ⎍ | 2-Pt mode     Simple 2-position control with a switching differential of 0.5 °C (±0.25 °C) for very difficult controlled systems with considerable outside temperature variations. |

**Reset functions**

**User-defined data:**
Press the button behind the pin opening for at least 1 second: This resets the user specific settings and the "Permanent-self-learning operating mode" as well as display of flow temperature, outside temperature and DHW setpoint to their default values (the heating engineer settings will not be changed). The clock starts at 12:00. During the reset time, all sections of the display light up, enabling them to be checked.

**All user-defined data plus heating engineer settings:**
Press the button behind the pin opening together with the warmer and colder buttons for at least 1 second.
After this reset, all **factory settings** will be reloaded (also refer to section "Factory settings").

Caution

Without inserted batteries, reset functions correctly for a maximum of 15 seconds only after removing REA23M from its base.

## Mechanical design

**Controller**

The REA23M has a plastic housing with a large display and easily accessible operating elements. The controller is removed from its base by sliding it upward. It is thus possible to replace the two 1.5 V alkaline batteries type **AA** in the compartment at the rear of the unit.

Battery change

About 3 months before the batteries are exhausted, battery symbol ▭ appears on the display, but all functions will be fully maintained. When changing the batteries, the current data will be retained for a maximum of 1 minute.

**Base**

The base can be fitted to most types of commercially available recessed conduit boxes or directly on the wall for wiring. The base only houses the terminals for the electrical connection between the controller and the connected devices. The entire electronics (including the relay with a potential free changeover contact) are accommodated in the controller.

## Notes

**Engineering**

- The room temperature controller should be located in the main living room
- The place of installation should be chosen such that the sensor can capture the room temperature as accurately as possible, without being affected by direct solar radiation or other heating or cooling sources
- Mounting height is approximately 1.5 m above the floor
- The controller can be fitted to most commercially available recessed conduit boxes or directly on the wall
- Above the unit, there must be sufficient clearance for removing the controller from its base and for replacing it

**Mounting and installation**

- When installing the controller, the base must first be fitted and wired. Then, the unit can be slid onto the base from above
- For more detailed information, please refer to the Installation Instructions supplied with the controller
- For the electrical installation, the local safety regulations must be complied with
- The remote operation contact T1 / T2 must be wired separately using a separate shielded cable

**Commissioning**

- The battery transit tab, which prevents inadvertent operation of the controller during transport and storage, must be removed
- The control mode can be changed on the heating engineer level
- If the reference room is equipped with thermostatic radiator valves, they must be set to their fully open position
- If the displayed room temperature does not agree with the effective room temperature, the temperature sensor should be recalibrated (refer to "Sensor calibration")

**Technical data**

| | | |
|---|---|---|
| Power supply | OpenTherm bus | |
| | Connection | 2 wires, interchangeable |
| | Length of cable | Max. 50 m |
| | Resistance of cable | Max. 2 x 5 Ω |
| | Power consumption | 35 mW (typical) |
| Battery data | Batteries (Alkaline AA) | 2 x 1.5 V |
| | Battery life | Approx. 2 years |
| | Backup for battery change | Max. 1 minute |
| Data backup (unit re-moved from base / no batteries inserted) | Data backup (unit removed from base / no batteries inserted) | |
| | User settings | Approx. 10 years |
| | Actual time (without batteries) | Max. 1 minute |
| Safety data | Safety class | III to EN 60730 |
| | | when installed according to regulations |
| | Degree of protection of housing | IP 20 to EN 60529 |
| | Pollution | Environment to EN 60730 |
| Sensing element various features | Sensing element | NTC 10 kΩ ±1 % at 25 °C |
| | Measuring range | 0…50 °C |
| | Time constant | Max. 10 min |
| | Setpoint setting ranges | |
| | Normal temperature | 5…29 °C |
| | Economy temperature | 5…29 °C |
| | Frost protection temperature | 5...29 °C (factory setting 5 °C) |
| | Resolution of settings and display | |
| | Setpoints | 0.2 °C |
| | Switching times | 10 min |
| | Measurement of actual value | 0.1 °C |
| | Display of actual value | 0.2 °C |
| | Display of time | 1 min |
| Norms and standards | C€ conformity | |
| | Electromagnetic compatibility | 89/336/EWG |
| | Low voltage directive | 2006/95/EWG |
| | Product safety | |
| | Automatic electrical controls for household and similar use | EN 60730-1, EN 60730-2-9 |
| | OpenTherm Plus (OT/+) | OpenTherm Product Specification 2.2a |
| | | OpenTherm Test Specification 1.2 |
| | Electromagnetic compatibility | |
| | Immunity | EN 61000-6-1, EN 61000-6-2, EN50 090-2 |
| | Emissions | EN 61000-6-3, EN 61000-6-4, EN50 090-2-2 |

Room temperature controller REA23M

| Environmental conditions | Operation | |
|---|---|---|
| | Climatic conditions | 3K3 to IEC 60 721-3 |
| | Perm. Ambient temperature | 5…40 °C |
| | Humidity | < 85 % r.h. |
| | Storage and transport | |
| | Climatic conditions | 2K3 to IEC 60 721-3 |
| | Temperature | -25…70 °C |
| | Humidity | < 93 % r.h. |
| | Mechanism | 2M2 to IEC 60 721-3 |
| Weight | Incl. package | 0.31 kg |
| Color | Housing | Signal white RAL9003 |
| | Base | Gray RAL7038 |
| Size | Housing | 140 x 104.5 x 30 mm |

**Connection diagram**



2266A01
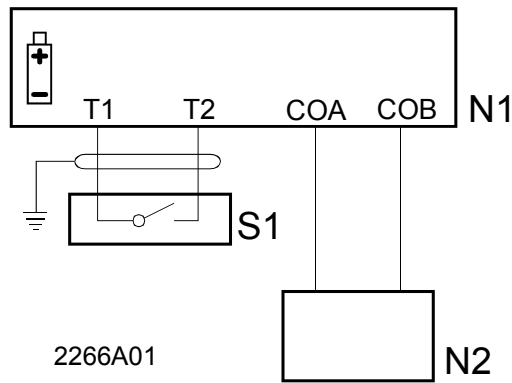
N1   Room temperature controller REA23M
S1   Remote operator unit (potential free)
T1   Signal „Remote operation"
T2   Signal „Remote operation"
COA  OpenTherm contact A (interchangeable)
COB  OpenTherm contact B (interchangeable)
N2   BMU OpenTherm Plus

**Application example**



2266S01
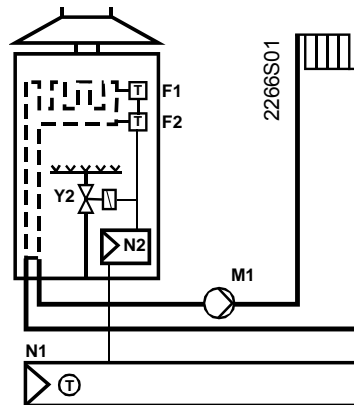
Instantaneous water heater

F1   Thermal reset limit thermostat
F2   Safety limit thermostat
M1   Circulating pump
N1   Room temperature controller REA23M
N2   BMU
Y2   Motorized 2-port valve

**Dimensions**

30

140

123

99

78.8

+
−

2216M01

Ø60

□56

12

11.75

83.50

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Subject to alteration

Building Technologies
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Room temperature controller REA23M

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