**Temperature regulating unit for heating and cooling**

**series 155**

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**Product range**

Code 1556.2  Temperature regulating unit for heating and cooling, in manifold box preassembled with manifolds

Code 151000  Room thermostat and indoor sensor

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**Technical specification**

- **Materials:**
  - Body: G-MS 58 brass
  - Hydraulic seals: EPDM

- **Mixing valve:** 4-way

- **Medium:** water, glycol solutions

- **Max. percentage of glycol:** 30%

- **Temperature setting range:** 5 – 60°C

- **Max. working pressure:** 6 bar

- **Temperature gauge scale:** 0 – 60°C

- **Connections to the manifold:** 1 1/2” with union connection

- **Primary circuit connections:** 1" F with union

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**Servomotor**

- **Electrically powered:** 230 V - 50 Hz

- **Rating:** 1.3 VA

- **Cycle time:** 210 s

- **Torque:** 6 N·m

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**Pump**

- **Electronic pump:** UPE 25-60

- **Total consumption:** – 110 W

- **Max. flow rate:** 3.5 m³/h

- **Max. ambient relative humidity:** 95%

- **Ambient temperature:** 0 – 40°C

- **Protection class:** IP 42

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**Function**

The temperature regulating unit is designed to guarantee the correct contribution of heating energy required by the user, by measuring the outside and room temperature values to regulate the correct system flow for either heating and cooling. The unit is delivered with all the required components for a regulating circuit.

The unit is compact to save space and facilitates installation into an embedded wall box.

It is supplied complete with:

- 4-way mixing valve, servomotor, electronically-regulated pump, flow temperature sensor, return temperature sensor, outside temperature sensor, limit control sensor for relative humidity, temperature controller, flow temperature gauge, unions for connecting to the manifolds and to the primary circuit.

The unit is designed for connection for remote data transmission. This unit solves the problems of installation of regulating components in modern small and medium-sized systems, due to its compact size and ease of use.

The unit is supplied in a manifold box preassembled with manifolds.

*The unit is factory set for use with underfloor heating systems.*

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**Head available at regulating unit connections**

Operating at max. speed.

- **Factory setting:** proportional head regulation.
Dimensions

<table>
<thead>
<tr>
<th>Code</th>
<th>1556E2</th>
<th>1556F2</th>
<th>1556G2</th>
<th>1556H2</th>
<th>1556I2</th>
<th>1556L2</th>
<th>1556M2</th>
<th>1556N2</th>
<th>1556O2</th>
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<tr>
<td>Outlets</td>
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<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
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</table>

Characteristic components

1. Temperature controller for heating and cooling
2. Electronic pump UPE 25-60
3. Four-way mixing valve
4. Servomotor
5. Flow temperature sensor
6. Return temperature sensor
7. Outside temperature sensor
8. Room thermostat and indoor sensor (optional)
9. Limit control sensor for max. relative humidity RH%
10. Flow temperature sensor
11. Connection point for remote transmission

The regulating unit is preassembled with:
667 series flow distribution manifold, equipped with micrometric valves for calibrating individual circuits.
666 series return distribution manifold, equipped with shut-off valves on individual circuit specially designed for thermoelectric control.
5996 series head units with automatic air vent and discharge valve.

For more information see technical brochure 01044 GB
Temperature controller

The controller, which is normally installed on the unit, can also be positioned remotely, following the electrical wiring scheme.

The front panel of the controller shows the following functions:

1) The LED is lit when there is a risk of condensation forming in the cooling function (the mixing valve is closed). In the heating function, this lights up intermittently during the dried-out drying phase.

2) The LED is lit in the cooling function.

3) Pump operating (ON): LED lit continuously.

4) Mixing valve closing: LED lit. The LED is lit continuously when the controller is in the non-operative phase of regulation, for example, with T Outside between 18°C and 24°C (see characteristic curve).

5) Mixing valve opening: LED lit.

6) Sensor malfunction: LED lit.

7) Function selector, six different functions possible:
   a) Main controller off. In models where clock fitted, clock remains on. The frost protection function remains active.
   b) Controller operating in set-back mode. Has no effect on the cooling function.
   c) Controller operating in comfort mode. Has no effect on the cooling function.
   d) Controller in operation according to the cycles of the comfort or set-back modes, determined by the two-channel analogue clock, red indicator for heating times, blue indicator for cooling times (item 14).
   e) Controller de-activated (pump ON - mixing valve ON). This function guarantees heating to the maximum temperature set on the controller.
   f) Summer function. Cooling is activated if required by the ambient conditions (T Outside greater than the value set at point 10) and dependant on the clock settings. This activation takes place after ten minute if the outside temperature is more than 1°C above the set value. With the exclusion of heating, the frost protection function remains active.
   Note: Normally, with the clock programme, the changeover from heating to cooling takes place after the outside temperature has been higher than the set value for at least half an hour. This selector position can therefore be used to effect a changeover to cooling.

9) Temperature and characteristic curve selector. This selector enables the user to input the maximum required flow temperature, corresponding to the minimum outside design temperature.

Also enables optimisation of the standard configuration set at the factory, allowing personal control of the operation of the system.

If this value matches the setting on the main printed circuit board (item 6 PCB), the regulation complies with the calculation criteria given by the characteristic curve. If this value is different from the setting on the main printed circuit board (item 6 PCB) the controller will recalculate the new characteristic curve. The maximum set temperature, however, remains active. This selector also determines the characteristic cooling curve, as it uses the inclination of the first line of the curve, constructed for the heating (see characteristic curve graph).

10) Start or stop cooling selector. If the outside temperature is higher than the set value, the cooling function is activated.

**Factory setting**: 24°C.

**Characteristic curve**
The characteristic curve is determined taking into account the following parameters:

- **a)** Max flow temperature set on controller (item 9 PCB). Factory setting: 45°C.
- **b)** Min flow temperature set on printed circuit board (item 5 PCB). Factory setting: 20°C.
- **c)** Min outside temperature set on printed circuit board (item 1 PCB). Factory setting: -10°C.
- **d)** Outside temperature limit for heating start in summer, set on printed circuit board (item 3 PCB). Factory setting: 18°C.

The characteristic curve has a straight line format. In the example shown below, it has been calculated using the factory set values.

**Example of calculation of characteristic curve**

<table>
<thead>
<tr>
<th>X Axis</th>
<th>Y Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>TY</td>
</tr>
</tbody>
</table>

**Calculation of minimum and maximum points**

- Point A: given by the intersection of Tmax X (18°C) and Tmin Y (20°C).
- Point B: given by the intersection of Tmin X (-10°C) and Tmax Y (45°C).

**Calculation of slope change points**

- Calculate the difference ΔX between Tmax X and Tmin X. Thus: ΔX = 18 - (-10) = 28°C.
- Calculate the difference ΔY between Tmax Y and Tmin Y. Thus: ΔY = 45 - 20 = 25°C.

**Points of change C and D of the curve are identified as follows:**

- **Point C** given by the intersection between:
  - X = Tmax X - 25% ΔX = 18 - 0,25 · 28 = 11°C
  - Y = Tmin Y + 55% ΔY = 20 + 0,55 · 25 = 33,75°C

- **Point D** given by the intersection between:
  - X = Tmax X - 50% ΔX = 18 - 0,5 · 28 = 4°C
  - Y = Tmin Y + 80% ΔY = 20 + 0,8 · 25 = 40°C

**Point E** is the cooling starting point, whose characteristic curve has the same slope as section A-C. Point E given by the intersection between:

**Calculation of characteristic curve**

<table>
<thead>
<tr>
<th>T outside (°C)</th>
<th>Preparatory phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Passive phase</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T outside (°C)</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>T flow (°C)</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>
Correction selector for comfort mode.
Range of adjustment from -25% to +25%.
Factory setting: correction = 0%.
The selector determines a parallel displacement of the characteristic curve according to the new percentage value selected in the comfort range (red indicator).
Example: if the selector is set to +25%, its effect on the flow temperature will be as follows: -25% \( \Delta Y = 0.25 \cdot 25 = 6.25^\circ \text{C} \).
The characteristic curve is then moved upwards by 6.25°C. This has no effect on the cooling function.

**Curve with comfort correction**

Correction selector for set-back mode.
Range of adjustment from 0% to -50%.
Factory setting: correction = -25%.
The selector determines a parallel displacement of the characteristic curve according to the new percentage value selected in the set-back range (blue indicator).
Example: if the selector is set to -25%, its effect on the flow temperature will be as follows: -25% \( \Delta Y = -0.25 \cdot 25 = -6.25^\circ \text{C} \).
The characteristic curve is thus moved downwards by 6.25°C.
In addition, if, following this move, the flow temperature has to be lower than the minimum heating start temperature (Tmin Y), the following state will be obtained: circulator OFF and mixing valve closed. This has no effect on the cooling function.

**Curve with set-back correction**

Daily or weekly analogue clock, used to select the heating or cooling phases required with:
the red indicators for heating comfort and set-back, the blue indicators to start and stop cooling, white indicator for heating and cooling with the same time programme.
Factory configuration: daily mode, minimum selection interval 15 min.
The changeover from daily to weekly mode, with a 60 min. minimum selection interval, is carried out as follows:
raise the outer ring and move the drive ring to the required position; to do this, turn the pointer clockwise until the innermost notch coincides with one of the outer notches.

Reposition the outer ring, making sure that the reference day shown on it falls in the operating sector of the switching point.

**Printed circuit board**
The surface of the printed circuit board (PCB) identifies the following functions:

1) \( \Rightarrow \) Minimum outside temperature (Tmin X), adjustable from -5°C to -20°C, to which the set maximum flow temperature corresponds (Tmax Y). Factory setting: -10°C.

2) \( \Rightarrow \) Set-back mode exclusion selector, adjustable from 0°C to -20°C. Factory setting: -15°C.
If the outside temperature falls below the set value, the heating is reactivated according to the characteristic curve of the comfort mode.

3) \( \Rightarrow \) Maximum outside temperature to start heating, or summer limit, (Tmax Y), adjustable from 14°C to 22°C.
Factory setting: 18°C. An outside temperature higher than the set value will cause the following state: circulator OFF and mixing valve closed. An outside temperature 4°C higher than the set value will cause activation of the cooling, if this outside temperature is greater than the value set on the front panel, item 10. If this temperature is lower, cooling will start following a preparatory phase, where T_flow equals the set \( T_{min,Y} \) as at item 5 of the printed board circuit.
Example:
TO set on front panel=24°C, TO set on PCB= 18°C, \( T_{min,Y} = 20°C \).
Activation will take place: at TO = 22°C (18+4) = preparatory phase at TO = 24°C following the characteristic curve.

4) \( \Rightarrow \) Selection microswitch for screed setting drying program. Factory setting: OFF (1234).
This program is used for carrying out correct drying of the screed, above which the final flooring will be laid (its activation excludes all other functions).
The program has a duration of seven days: during the first three days, the flow temperature is maintained at 25°C, whilst for the remaining four days, the flow temperature is raised and maintained at the maximum temperature value set at point 9 on the front panel. The activation of this program is displayed by the flashing LED on the front panel, point 1.
The frequency of flashing indicates the number of drying days which have passed: one pulse every 8 seconds indicates day 1, two pulses every 8 seconds indicates day 2, etc. If the electricity has to be switched off in this phase, the controller will start its drying cycle again from the beginning. The front panel LED, point 1, continuously lit, indicates the end of the drying program. At this point the microswitch should be turned to OFF.
Note: In manual mode, the screed drying procedure cannot be activated. When cooling, this series of microswitches has the function of limiting the minimum temperature transmitted to the panel. This minimum temperature depends on the characteristics of the system and the type of air conditioning adopted. The different activation configurations are shown below.
Factory configuration: 16°C.
Selector for minimum flow temperature at heating start-up (Tmin Y).
Adjustable from 20°C to 40°C.
Factory setting: 20°C.

Maximum limit temperature selector.
Adjustable from 35°C to 65°C.
Factory setting: 50°C.

In case a higher value has been set at point 7 of the front panel, this will be restricted to the limit value.

Neutral zone regulation selector.
Adjustable from 1.5°C to 6°C.
Factory setting: 2°C (equivalent to ± 1°C).

Adjustable from 0% to 100%.

This selector is used to optimise the system output according to the difference in temperature between flow and return (ΔT).
ΔT is calculated as a percentage of the flow temperature calculated on the characteristic curve.

Example with factory setting values:
Flow temperature calculated on the characteristic curve:

T_flow set Y = 40°C (project conditions).

Thus:
ΔT = (40 - 20) = 20°C

If the return temperature measured (T_return Y) is T_return = 30°C

T_calculated flow = T_flow set Y + RF% · (T_return set Y - T_return Y)

This continuous comparison prevents room overheating caused by gratuitous heat sources modifying the heating load.
There is no effect on the cooling function.

When installing the RH% limit sensor according to the diagrams, as indicated, possible formation of condensation on the surface is anticipated.

In areas where the max RH% limit sensor is installed, adequate ventilation must always be present.
11) SE  Outside sensor wiring. Connect the outside sensor using 2-core cable (2x0.75) to the connector provided on the unit.

12) SR  Return sensor wiring. Factory fitted.

13) TA1  Room thermostat wiring. Optional.

14) PS  Pump shut-down variant. Sometimes the temperature regulating unit is installed in a system where there may be one or more users with different usage requirements. In this case, for users requiring ON/OFF operation, it may be necessary to shut down the unit circulator.

The electrical diagram shown below illustrates this possibility; the user auxiliary contact must be inserted in series with the normal wiring.

15) SM  Flow sensor wiring. Factory fitted.

16) C  Summer - winter circuit changeover valve wiring. This connection enables the 3-way valve to be activated automatically for hydraulic deviation between the boiler circuit and the chiller circuit. This takes place after the outside temperature has risen above the value set at point 3 for at least half an hour. Ten minutes later, the regulating unit pump is activated.

17) KA  Chiller activation wiring. This activation takes place in the same way as in point 16.

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### Table of sensor resistance values*

<table>
<thead>
<tr>
<th>°C</th>
<th>Ohm</th>
</tr>
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<td>-15</td>
<td>11.382</td>
</tr>
<tr>
<td>-12</td>
<td>9.912</td>
</tr>
<tr>
<td>-10</td>
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<tr>
<td>-6</td>
<td>7.439</td>
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<tr>
<td>-3</td>
<td>6.492</td>
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<tr>
<td>-2</td>
<td>6.206</td>
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<tr>
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<tr>
<td>85</td>
<td>0.276</td>
</tr>
</tbody>
</table>

*excluding max RH% limit sensor

### Safety

If the flow or outside sensor shows an ohm resistance value outside its working range (damaged or disconnected sensor), the following operating state is automatically activated:
Pump OFF, Mixing valve OFF, LED 7 continuously lit.

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### Use of safety thermostat

The safety thermostat has a special snap on connector. It can be used to stop the boiler and protect the panel circuits from dangerous overheating.

It prevents hot water from entering the panel circuits directly when cooling in the absence of automatic summer-winter changeover as at point 16.
**Frost protection function**

When the selector (point 6 on the front panel) is positioned on ⬆️ or ⬇️, there are two types of intervention:

a) If the flow temperature is below 7°C, the controller activates the operation of the unit until a flow temperature of 20°C is reached. When this value is reached, it will return to the inactive status.

b) If the outside temperature is below 5°C (+2 -0), the controller keeps the pump running.

**Anti-seize function**

If the pump remains inactive for twenty four hours, the following program automatically comes into operation, with:

- mixing valve open for 30 seconds,
- mixing valve closed for 30 seconds,
- pump ON for 60 seconds.

When this function is operating, it cannot be interrupted.

**Manual control**

Disconnect the wires on the back of the PCB on the right at the positions MA, marked No. 2 and MC No. 3.

Press on the screw on the protective cover and turn it to the position desired.

**Options**

Room thermostat, code 151000.

The regulating unit can be supplemented with a room thermostat, able to adjust the value of the flow temperature according to the actual room temperature. This configuration makes it possible to take account of gratuitous heat gains, by refining the value of the flow temperature, with optimum results in terms of comfort and energy saving. In cooling conditions, the setting on the thermostat should be increased by 2°C.

**Operation of the room thermostat**

The room thermostat makes it possible to optimise the operation of the system, as it modifies the regulating curve automatically. Depending on the time periods for comfort and set-back selected on the clock and the room temperature setting, it will read the actual room temperature. On the basis of this parameter, it will make any necessary modification to the characteristic curve (A) for the purpose of accelerating operation and preventing excessive heating and cooling of the room.

The difference between the actual room temperature measured by the thermostat and the set temperature produces an amplified effect in relation to that produced by a similar variation in the outside temperature.

A difference of 1°C in the room temperature causes a move of the characteristic curve equal to 7°C of the outside temperature, with the corresponding variation in flow temperature.

For example, if $T_{room\ set} = 20°C$ and $T_{room\ measured} = 19°C$, than the difference of 1°C will cause a movement of the characteristic curve of 7°C towards the left (B). The flow temperature will consequently be raised. In the case of a negative difference, the movement will take place on the curve C.

This behaviour is applicable for a maximum difference of 3°C in the room temperature.

In addition, the maximum temperature limit set at item 6 on the PCB remains active.

In the set-back band, the set room temperature is automatically reduced by 2°C, thus defining $T_{set\ set-back}$.

This reduction will cause a move to the right of the characteristic curve, equating to 14°C of the outside temperature (D), with a corresponding variation in flow temperature.

Whenever the measured room temperature falls below $T_{set\ set-back}$, the initial characteristic curve (A) will be restored with the set-back correction set at point 12 on the front panel.

**Curve with room thermostat regulation**

![Curve with room thermostat regulation](image)

**Room thermostat electrical connection**

Install the room thermostats and connect by sheathed 2-core cable (2 x 0.75) to the terminal strip of the regulator PCB, as shown in the diagram below.

**WARNING** - if the connecting cable between the thermostat and the control unit is not sheathed, it must be run in its own ducting. The maximum length is 150 m.
Code 1556.2
Temperature regulating unit preassembled with manifold for radiant panels in box. Primary circuit connections: 1” F with union. Manifold outlets: 3/4” M. Brass body. EPDM hydraulic seals. Maximum working pressure: 6 bar. Ambient temperature: 0 to 40°C. Setting temperature range: 5 to 60°C (factory setting: 45°C). Complete with: 4-way mixing valve; mixing valve servomotor, with the following specification: electrical supply: 230 V 50 Hz. Rating: 1,3 VA. Cycle time: 210 s. Torque: 6 N·m; electronic pump: UPE 25-60. Maximum flow rate: 3,5 m³/h. Protection class: IP 42; temperature controller with with daily/weekly clock; flow temperature sensor; return temperature sensor; outside temperature sensor. Limit control sensor for relative humidity. Flow pocket temperature gauge, scale 0 – 60°C; flow manifold, 5 outlets (5 to 13) complete with regulating valves; return manifold, 5 outlets (5 to 13) complete with shut-off valves suitable for thermoelectric heads; head unit with air vent valve and drain valve; box in sheet steel, RAL 9010 white colour, depth adjustable from 150 to 190 mm, complete with floor supports with height adjustable from 270 to 410 mm.

Code 151000
Room thermostat and indoor sensor for temperature regulating unit.

We reserve the right to change our products and their relevant technical data, contained in this publication, at any time and without prior notice.