Temperature regulating unit for heating and cooling

series 152

CALEFFI

01088/03 GB

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 temperature for either heating or cooling.

It is supplied complete with:
4-way mixing valve, servomotor, pump, flow temperature sensor, outside temperature sensor, system temperature return sensor, cooling surface humidity control sensor, temperature controller, flow and return thermometers, unions for connecting to the primary and secondary circuits, with preformed shell insulation.
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 factory set for use with underfloor heating systems.

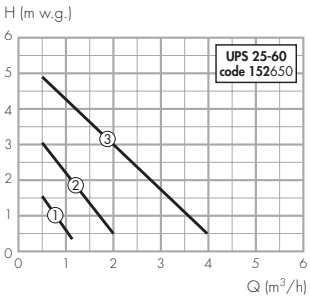
Product range

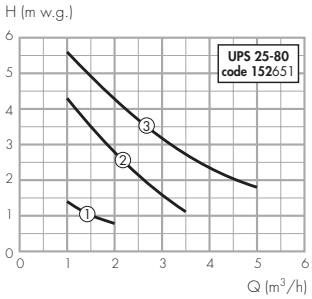
Code 152650	Temperature regulating unit for heating and cooling with pump UPS 25-60
Code 152651	Temperature regulating unit for heating and cooling with pump UPS 25-80
Code 151000	Room thermostat and indoor sensor

Technical specification

- Materials:	- body:	grey cast iron GG19
	- hydraulic seals:	EPDM
	- insulation shell:	PPM
- Mixing valve:		4-way
- Medium:		water, glycol solutions
- Max percentage of glycol:		30%
- Working temperature range:		5÷60°C
- Max working pressure:		6 bar
- By-pass regulating range:		0,05÷0,5 bar
- Thermometer scale:		0÷60°C
- Primary and secondary circuit connections:		1" F with union
- Servomotor:	electric supply:	230V 50 Hz
	rating:	10 VA
	cycle time:	240 s
	torque:	10 N·m
- Grundfos pump:	cod. 152650	model UPS 25-60
	cod. 152651	model UPS 25-80
- Max ambient relative humidity:		95%
- Ambient temperature:		0÷40°C
- Protection class:		IP 42

Head available at regulating unit connections



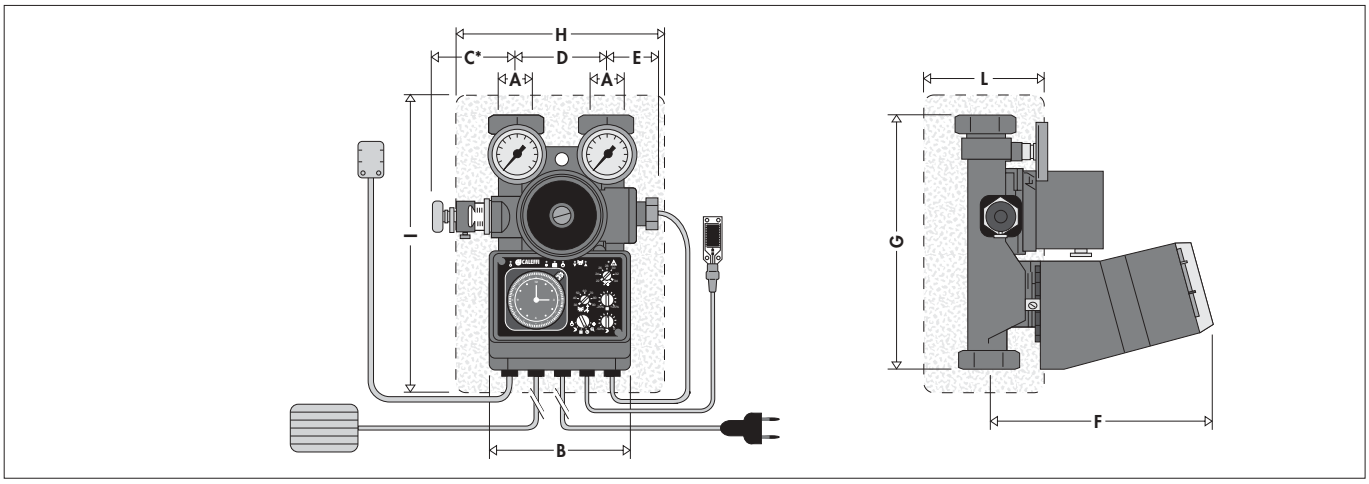


Power consumption

Speed	I (A)	P (W)	n (rpm)
3	0,45	100	1800
2	0,30	65	1100
1	0,17	35	700

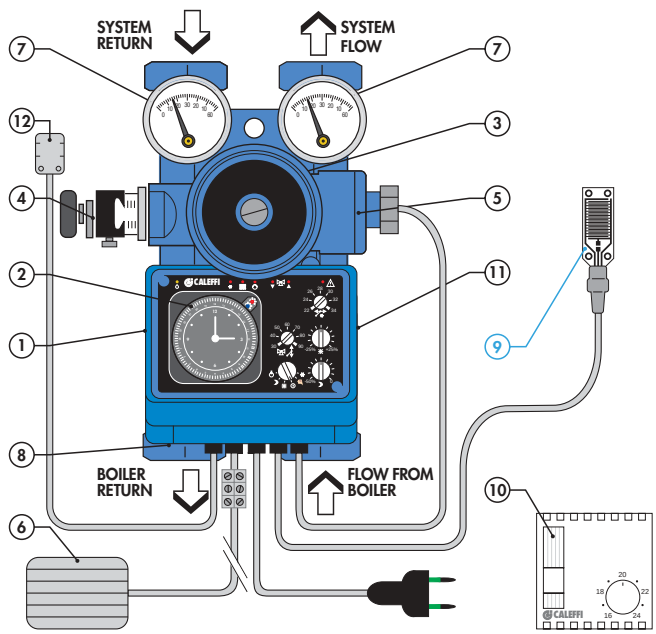
Speed	I (A)	P (W)	n (rpm)
3	1,13	250	2450
2	1,04	220	1500
1	0,69	140	1000

Dimensions



Code	A	B	C	D	E	F	G	H	I	L
152650/651	1"	142	78	90	40	234	267	205	320	120

Characteristic components



1 **4-way mixing valve.**

2 **Digital temperature controller for heating and cooling.**

3 **Circulating pump:**
code **152**650 GRUNDFOS UPS 25-60
code **152**651 GRUNDFOS UPS 25-80.

4 **Differential by-pass valve** with graduated scale.

5 **Flow temperature sensor.**

6 **Outside temperature sensor** - connected via terminal.*

7 **Circuit flow and return thermometers** in pockets.

8 **Connection point for remote transmission.**

9 **Limit control sensor for max relative humidity RH%.***

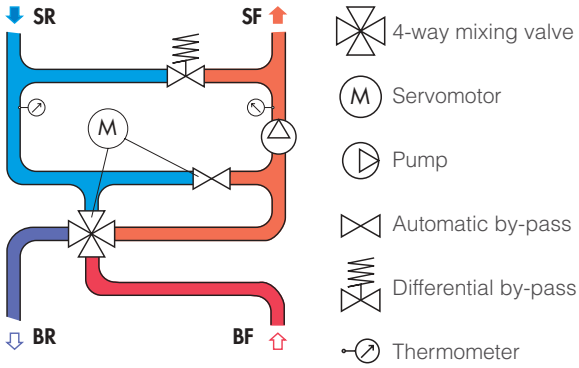
10 **Room thermostat and indoor sensor** (option for 152).*

11 **Servomotor.**

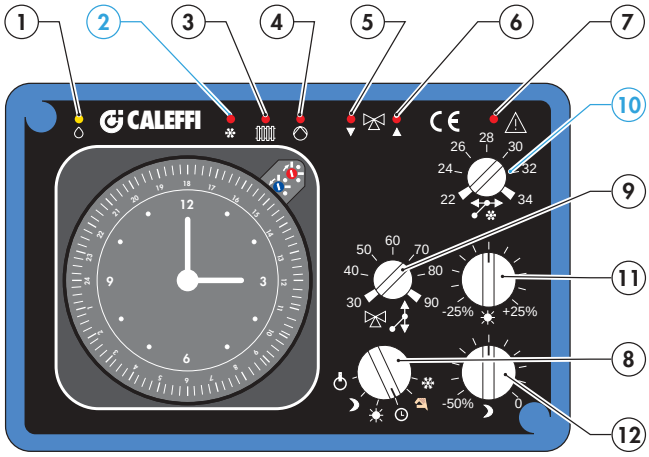
12 **Return temperature sensor.**

* *Max length of sensor cable: 150 m.*

Hydraulic diagram



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 screed drying phase.

2) The LED is lit in the cooling function.

3) The LED is lit in the heating function.

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

5) 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).

6) Mixing valve opening: LED lit.

7) Sensor malfunction: LED lit.

8) Function selector, 6 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 13).

e) Controller de-activated (pump ON - mixing valve ON).
This function guarantees heating to the maximum temperature value set on the printed circuit board (PCB).
Has no effect on the cooling function.

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

X Axis - Outside temperature - TX
Y Axis - Flow temperature - TY

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.

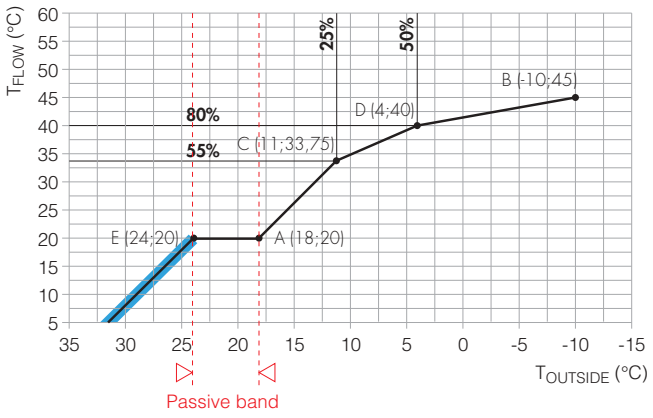
Points of change C and D of the curve are identified as follows:

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

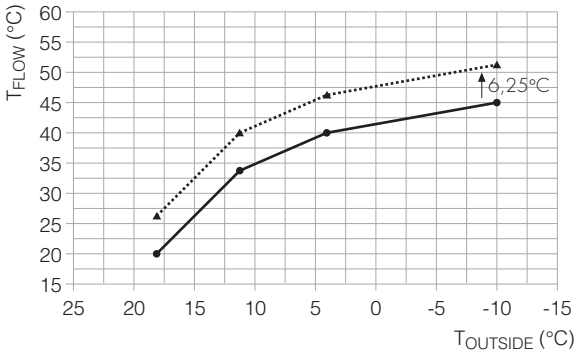
Point E is the cooling starting point, whose characteristic curve has the same slope as section A-C.
Point E given by the intersection between: TX = value set in item 10 (24°C) and TY = Tmin Y (20°C).

Characteristic curve



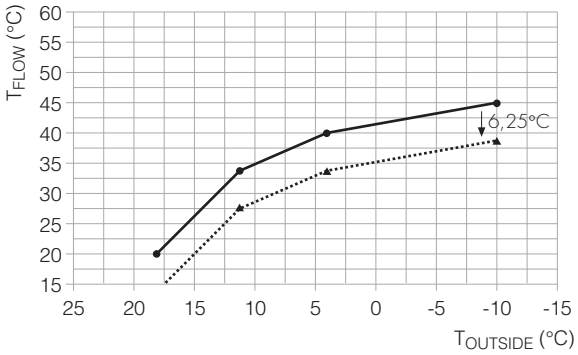
11) Correction selector for comfort mode.
Range of adjustment from -25% to +25%.
Factory setting: correction = 0%.
The selector determines a parallel displacement of the characteristic curve according to the new percentage value selected in the comfort range (red indicator).
Example: if the selector is set to +25%, its effect on the flow temperature will be as follows:
+25% ΔY = 0,25 · 25 = 6,25°C.
The characteristic curve is then moved upwards by 6,25°C.
This has no effect on the cooling function.

Curve with comfort correction

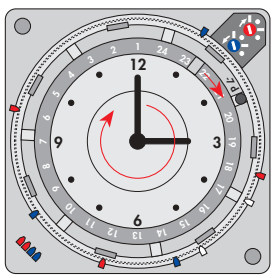


12) Correction selector for set-back mode.
Range of adjustment from 0% to -50%.
Factory setting: correction = -25%.
The selector determines a parallel displacement of the characteristic curve according to the new percentage value selected in the set-back range (blue indicator).
Example: if the selector is set to -25%, its effect on the flow temperature will be as follows:
-25% ΔY = -0,25 · 25 = -6,25°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

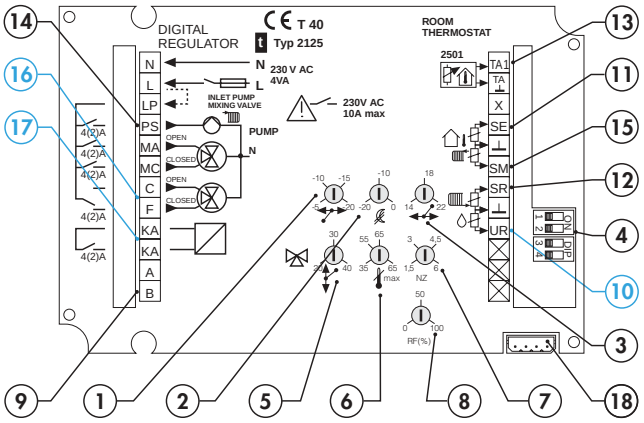


13) Daily or weekly analogue clock, used to select the heating and cooling phases required with:
the red indicators for heating comfort and set-back and the blue indicators to start and stop cooling.
Factory configuration: daily mode, minimum selection interval 15 min..
The changeover from daily to weekly 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.



11) Printed circuit board

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

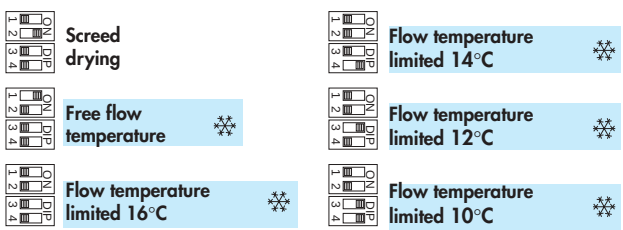


1) Minimum outside temperature (Tmin X), adjustable from -5°C to -20°C, to which the set maximum flow temperature corresponds (Tmax Y). *Factory setting: -10°C.*

2) 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) Maximum outside temperature to start heating, or summer limit, (Tmax X), 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. - e.g.: T_o set on front panel=24°C, T_o set on PCB=22°C.
Activation will take place at T_o=26°C (22+4).

4) 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.



5) Selector for minimum flow temperature at heating start-up (Tmin Y).
Adjustable from 20°C to 40°C.
Factory setting: 20°C.

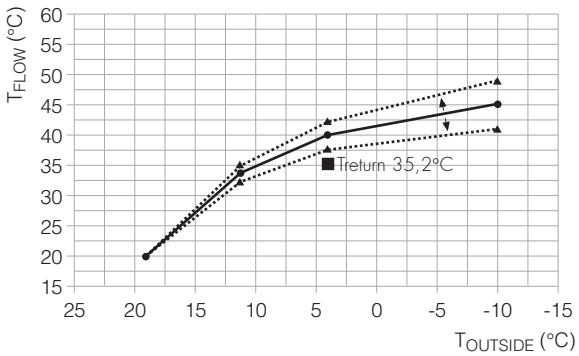
6) Maximum limit temperature selector.
Adjustable from 35°C to 65°C.
Factory setting: 50°C
In case a higher value has been set at point 7 of the front panel, this will be restricted to the limit value.

7) **NZ** Neutral zone regulation selector.
Adjustable from 1,5°C to 6°C.
Factory setting: 2°C (equivalent to ±1°C).
If the flow temperature variation remains within the temperature value selected in the neutral zone, the mixing valve remains inactive.
When cooling, the neutral zone automatically takes the value 1,5°C.

8) **RF(%)** Return sensor regulation selector.
Adjustable from 0% to 100%.
Factory setting: 80%.
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.
$\Delta TY = (T_{flow}$ set Y-Tmin Y)
$\Delta T = \Delta TY \cdot$ %set $\cdot$ 0,3.
T_{return} set Y = T_{flow} set Y - ΔT.

Example with factory setting values:
flow temperature calculated on the characteristic curve, T_{flow} set Y = 40°C (project conditions).
Thus:
ΔTY = (40 - 20) = 20°C
ΔT = 20 · 0,8 · 0,3 = 4,8°C
T_{return} set Y = 40 - 4,8 = 35,2°C.
If the return temperature measured (T_{return} Y) is ≠ T_{return} set Y, the controller will modify the characteristic curve, moving it upwards or downwards, to move the return temperature to the set value.
This continuous comparison prevents room overheating caused by gratuitous heat sources modifying the heating load. There is no effect on the cooling function.

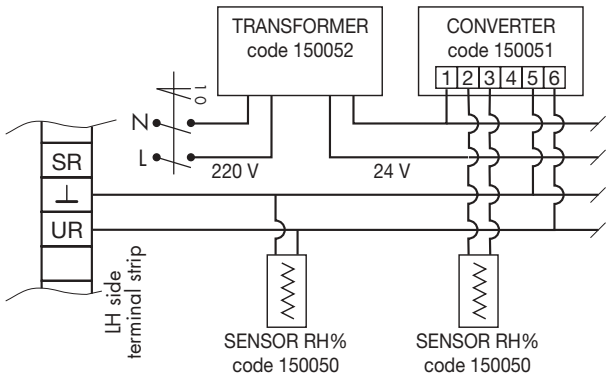
Curve with return temperature regulation



9) Auxiliary contact. This contact opens when the mixing valve is completely closed to the secondary and open to the primary. It can be used to shut down the pump of the primary circuit or the boiler.

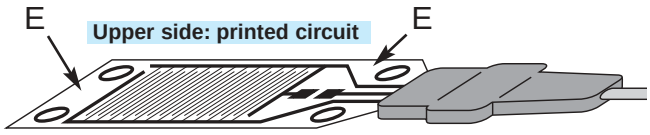
10) **UR** Relative humidity sensor wiring. This sensor is used to detect the limiting value of relative humidity to prevent condensation on the cooling surface.
This is calibrated for RH= 80÷85%. When the calibrated value is reached, this will cause the following state: mixing valve closed, pump ON.

If various zones at risk of condensation are to be controlled, the humidity sensor must be connected to a suitable interface kit (transformer, converter and humidity sensor). Up to 12 converters plus sensor can be connected to a single transformer.



Humidity sensor control
At the start of each cooling season, the operating condition of the sensor should be checked by placing a damp pad on its surface; this operation should cause the mixing valve to close and the yellow LED, point 1 on the front panel, to light.

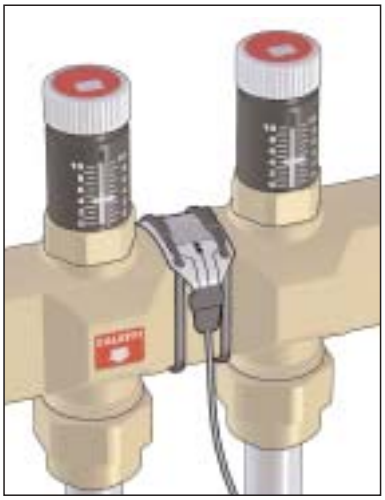
Positioning humidity sensor
The umidity sensor must be positioned at the point where there is most risk of the formation of condensation, depending on the characteristics of the system. It must be positioned with the printed part upward, according to the diagrams shown below.
Fix ends E, taking care that the central part adheres perfectly to the manifold or to the piping.

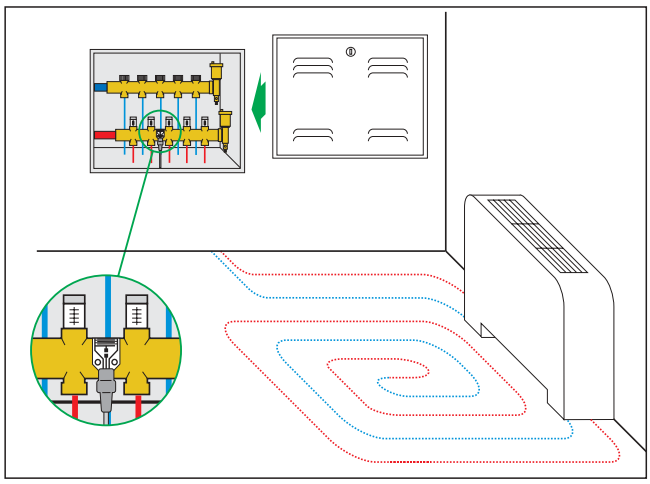


Lower side: sited on the cooling surface

Layouts for the correct positioning of the max RH% limit sensor.

The sensor should be fixed to the manifold installed in the position where the RH% relative humidity value has not to exceed the safety limits. Fixing in ensured by inserting the two straps contained in the package through the suitable holes on the sensor.



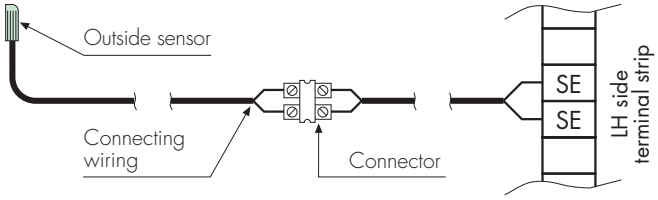


The maximum heat energy that the panel can produce in relation with the climate values recorded, can be reached by controlling the below outlined parameters.

- Minimum flow temperature on the characteristic curve, which can be selected through the microswitch (point 4 on the back panel).
- Sensor (code 150050) controlled maximum RH% limit.
- Room temperature controlled through room thermostat (code 151000).
- Room temperature and relative humidity controlled through a dedicated fan-coil).

N.B.: When installing the RH% limit sensor according to the diagrams, as indicated, possible formation of condensation on the surface. **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.



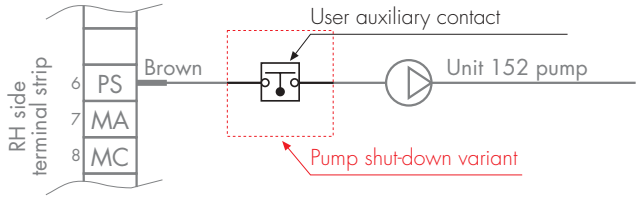
12) SR Return sensor wiring. Factory fitted.

13) TA1 Room thermostat wiring. Optional.

14) 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.

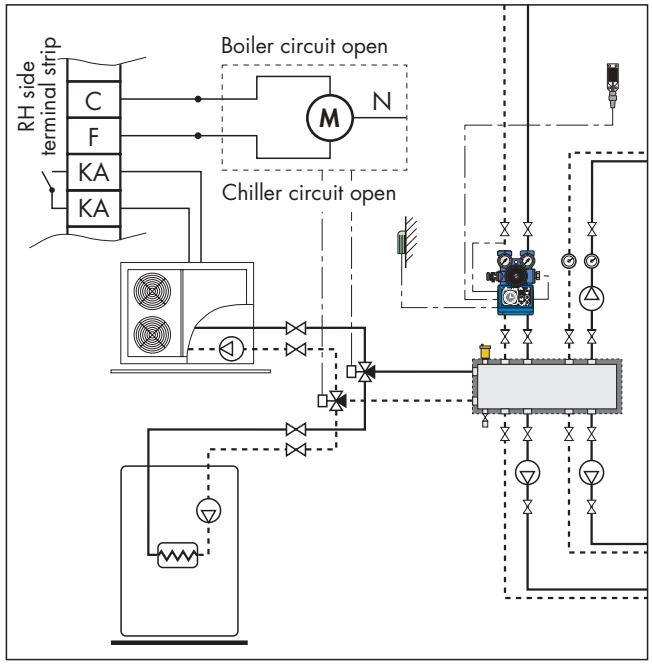
15) SM Flow sensor wiring. Factory fitted.

Pump shut-down wiring



16) C F 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 10 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.



18) Remote data transmission connector.

Table of sensor resistance values*

**excluding max RH% limit sensor*

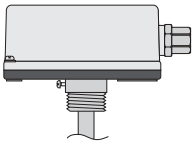
°C	Ohm	°C	Ohm	°C	Ohm	°C	Ohm	°C	Ohm
-15	11.382	0	5.632	20	2.431	55	690	90	240
-12	9.912	2	5.187	25	2.000	60	587	95	209
-10	8.933	4	4.742	30	1.655	65	501	100	183
-6	7.439	6	4.347	35	1.376	70	430		
-3	6.492	8	4.000	40	1.150	75	370		
-2	6.206	10	3.553	45	966	80	319		
0	5.632	15	2.971	50	815	85	276		

Safety

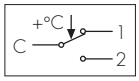
If the flow or outside sensor shows an ohm resistance value outside its working range (damaged or disconnected sensor), the following operating state is automatically activated:
Pump OFF, Mixing valve OFF, LED 7 continuously lit.

Safety thermostat code 622001

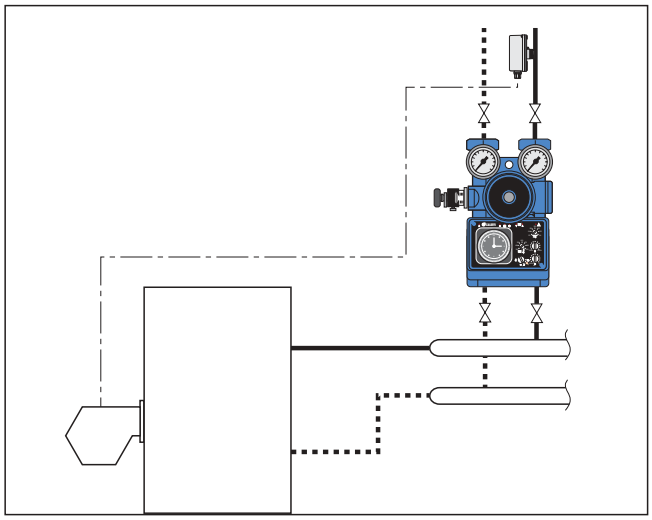
Additional for use with underfloor heating systems.



- Range of adjustment: 5 ÷ 55°C
- Factory setting: 50°C
- Protection class: IP 40
- Contacts load: (C-1) 10(2,5)A / 250V
- Contacts load: (C-2) 1(1)A / 250V



Example of safety thermostat application on system low temperature branch circuit



Frost protection function

When the selector, point 6 on the front panel, is positioned to ⏻ 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.

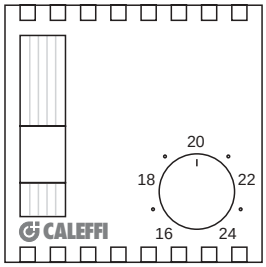
Manual control

To carry out adjustment:
- Remove the servomotor fixing screws.
- Lift the servomotor. This gives access to the control knob.
  Refer to the information given on the knob itself.

Options

Room thermostat, code 151000.

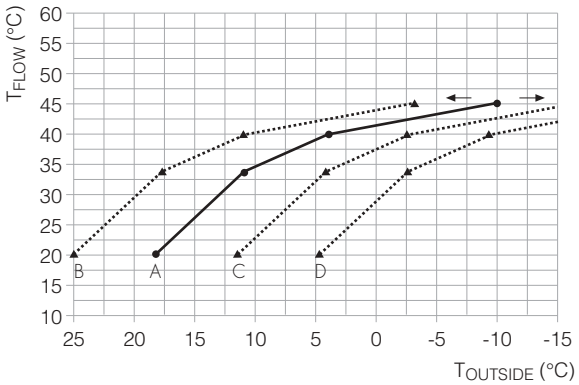
The regulating unit can be supplemented with a room thermostat, able to adjust the value of the flow temperature according to the actual room temperature. This configuration makes it possible to take account of gratuitous heat gains, by refining the value of the flow temperature, with optimum results 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

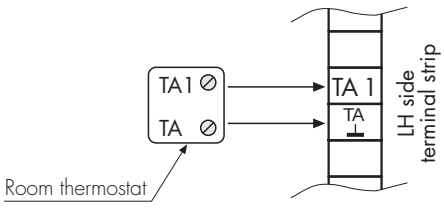
The room thermostat makes it possible to optimise the operation of the system, as it modifies the regulating curve automatically.
Depending on the time periods for comfort and set-back selected on the clock and the room temperature setting, it will read the actual room temperature. On the basis of this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



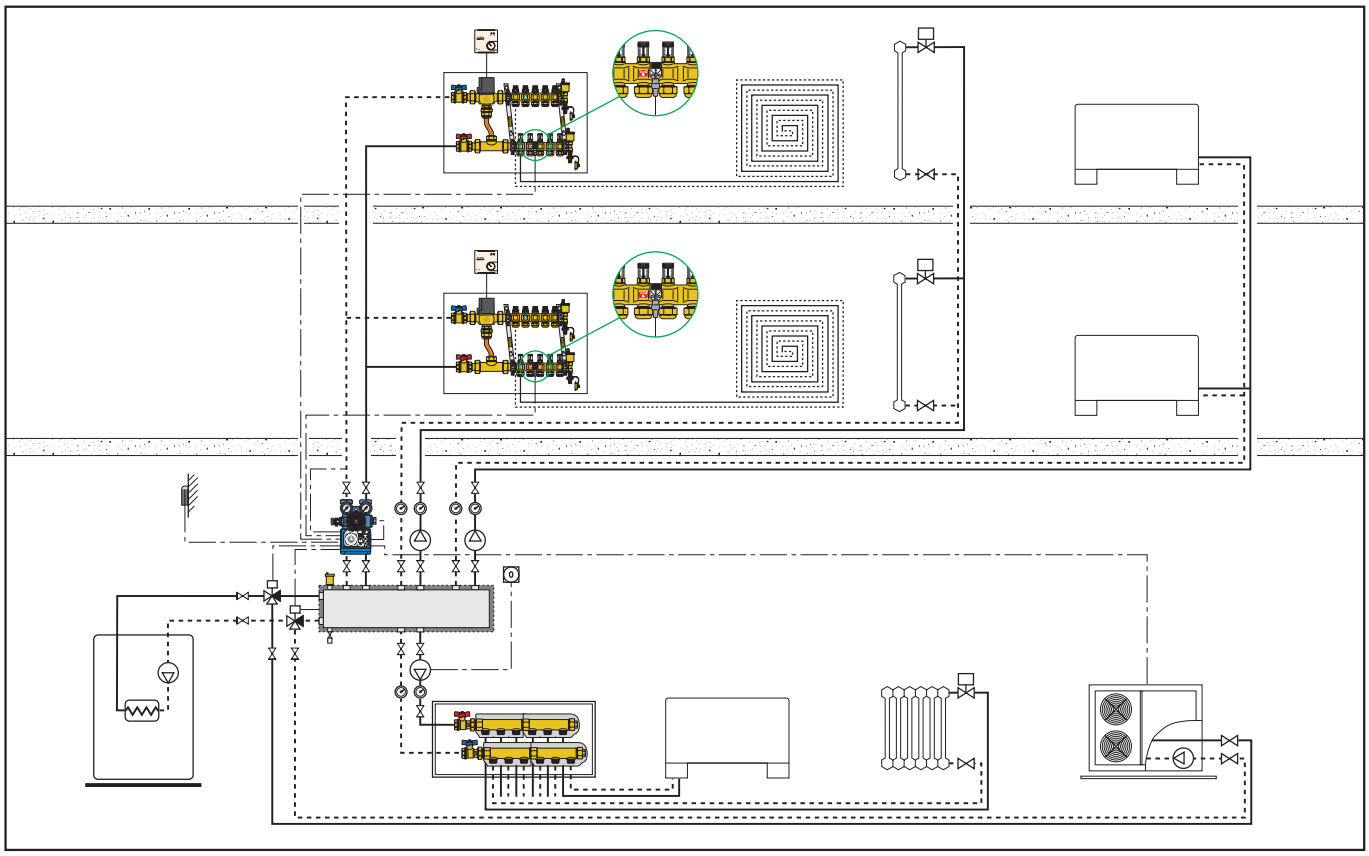
Room thermostat electrical connection

Install the room thermostat and connect by sheathed 2-core cable (2x0,75) 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.

Application diagram



SPECIFICATION SUMMARIES

Code 152650

Temperature regulating unit for heating and cooling. Connections 1" F with unions. Body in grey cast iron GG19. Hydraulic seals in EPDM. Maximum working pressure 6 bar. Ambient temperature from 0 to 40°C. Regulating temperature from 5 to 60°C (factory settings: heating 45°C, cooling 16°C). Maximum ambient relative humidity 95%. Consisting of: 4-way mixing valve; mixing valve servomotor with the following characteristics: power supply 230 V 50 Hz, rating 10 VA, cycle time 240 s, torque 10 N·m. Pump UPS 25-60. By-pass valve with regulating scale from 0,05 to 0,5 bar. Temperature controller with two channel clock, for daily/weekly programming. Flow temperature sensor. Return temperature sensor. Outside temperature sensor, connectable to terminal. Maximum RH% limit control sensor. Flow and return pocket thermometers, scale 0÷60°C. Automatic summer/winter cycle changeover. Provided with connection for remote data transmission. Protection class IP 42. Complete with PPM insulation.

Code 152651

Temperature regulating unit for heating and cooling. Connections 1" F with unions. Body in grey cast iron GG19. Hydraulic seals in EPDM. Maximum working pressure 6 bar. Ambient temperature from 0 to 40°C. Regulating temperature from 5 to 60°C (factory settings: heating 45°C, cooling 16°C). Maximum ambient relative humidity 95%. Consisting of: 4-way mixing valve; mixing valve servomotor with the following characteristics: power supply 230 V 50 Hz, rating 10 VA, cycle time 240 s, torque 10 N·m. Pump UPS 25-80. By-pass valve with regulating scale from 0,05 channel clock, for daily/weekly programming. Flow temperature sensor. Return temperature sensor. Outside temperature sensor, connectable to terminal. Maximum RH% limit control sensor. Flow and return pocket thermometers, scale 0÷60°C. Automatic summer/winter cycle changeover. Provided with connection for remote data transmission. Protection class IP 42. Complete with PPM insulation.

Code 151000

Room thermostat and indoor sensor for temperature regulating unit.

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