# Modulating temperature regulating unit for heating and cooling with high temperature distribution kit

## series 161

cert. n° 0003 ISO 9001

01096/04 GB

### Function

The modulating temperature regulating unit with high temperature distribution kit is designed for use with mixed type systems consisting of radiant panels and radiators or fan coils in combination with distribution manifolds for radiant panels.

**This unit, complete with digital temperature controller, controls the temperature of the fluid sent to radiant panels as a function of the actual thermal load.**

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

The unit is supplied complete with digital temperature controller for both heating and cooling, a motorised three-way valve, components to limit relative humidity, a three-speed pump, flow and return sensors, a safety thermostat, flow and return temperature gauges, a pressure gauge, adjustable drain valve and shut-off valves on the primary circuit.

The function of the kit is to distribute part of the primary fluid from the boiler or chiller unit to the heater and cooler units. It acts as a hydronic separator for underfloor heating circuits and is supplied complete with an adjustable differential by-pass for the primary circuit.

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### Product range

| | |
|---|---|
| Code 1615.2 003 | Modulating temperature regulating unit with high temperature distribution kit, preassembled with manifolds and box |
| Code 161503 | High temperature distribution kit with 3-outlet manifold and differential by-pass |

### Technical specification

**Temperature controller**

| | |
|---|---|
| Electric supply: | 230 V - 50 Hz |
| Protection class: | IP 40 |

**Three-way valve**

| | |
|---|---|
| Materials: - Body: | brass EN 12165 CW617N, nickel plated |
| - Ball: | brass EN 12165 CW617N, chrome plated |
| - Hydraulic seals: | EPDM |

**Hydraulic unit**

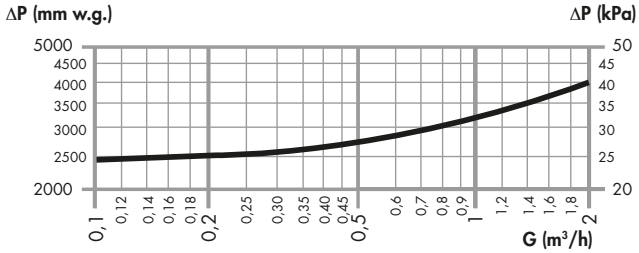
| | |
|---|---|
| Materials: - Piping: | polished copper |
| - Fittings: | brass, EN 12164 CW614N |
| - Shut-off valves: | brass EN 12165 CW617N, nickel plated |

| | |
|---|---|
| Temperature gauge scale: | 0 – 80°C |
| Pressure gauge scale: | 0 – 6 bar |
| Connections to primary circuit: | 3/4" M |
| Connections to manifold: | 1 1/4" M union connection |
| Manifold outlet connections: | 3/4" M |

**Actuator**

| | |
|---|---|
| Three-point type: | |
| Electric supply: | 230 V - 50 Hz |
| Operating time: | 95 s |
| Power consumption: | 4 W |
| Protection class: | IP 54 |
| Max. ambient temperature: | 65°C |
| Protective cover: | self extinguishing VO |
| Medium: | water, glycol solutions |
| Max. percentage of glycol: | 30% |
| Setting temperature range: | 7 – 78°C |
| Primary inlet temperature range: | 5 – 90°C |
| Max. working pressure: | 10 bar |
| Panel manifold differential by-pass setting: | 25 kPa (2.500 mm w.g.) |

**Differential by-pass hydraulic characteristics**



**Flow/return temperature sensor**

| | |
|---|---|
| NTC type | |
| Working temperature range: | -10 – 125°C |
| Time constant: | 2,5 s |
| Response: | 10.000 Ω at 25°C |
| Beta value: | 25/85°C 3977 ±1,5% |
| Two-wire cable with 1/8" M connection | |

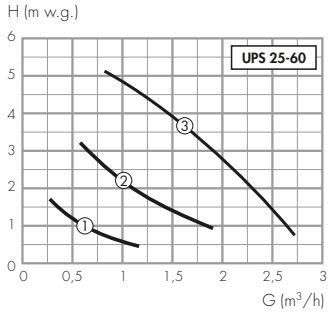
**Safety thermostat**

| | |
|---|---|
| Setting temperature: | 55°C ±3°C |
| Protection class: | IP 55 |
| Contacts rating: | 10 A - 240 V |

**Pump**

| | |
|---|---|
| Three-speed pump: | UPS 25-60 |
| Material: - Body: | cast iron GG 15/20 |
| Max. ambient relative humidity: | 95% |
| Max. ambient temperature: | 80°C |
| Protection class: | IP 44 |
| Pump centre distance: | 130 mm |
| Pump connections: | 1 1/2" with union connection |

**Head available at regulating unit connections**




**Power consumption**

| Speed | I (A) | P (W) | n (r.p.m.) |
|---|---|---|---|
| 3 | 0,40 | 90 | 1800 |
| 2 | 0,30 | 65 | 1100 |
| 1 | 0,20 | 45 | 700 |

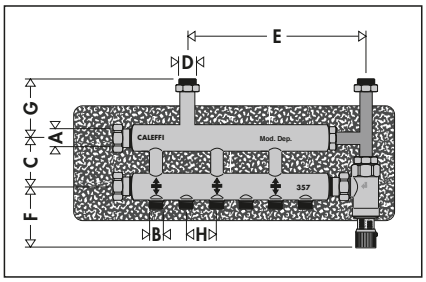
**High temperature distribution kit technical specification - code 161503**

| | |
|---|---|
| Materials: - Manifold: | brass EN 1982 CB753S |
| - By-pass: | brass EN 12165 CW617N |
| - Hydraulic seals: | EPDM |
| Max. working pressure: | 10 bar |
| Max. working temperature: | 100°C |
| Differential by-pass setting: | 10 – 60 kPa (1 – 6 m w.g.) |
| Manifold internal diameter: | Ø 20 mm |
| Manifold connections: - Inlet: | 3/4" F nut |
| - To the regulating unit: | 1" M |
| - Outlets: | 23 p. 1,5 M - Ø 18 mm |
| - Outlet center distance: | 50 mm |

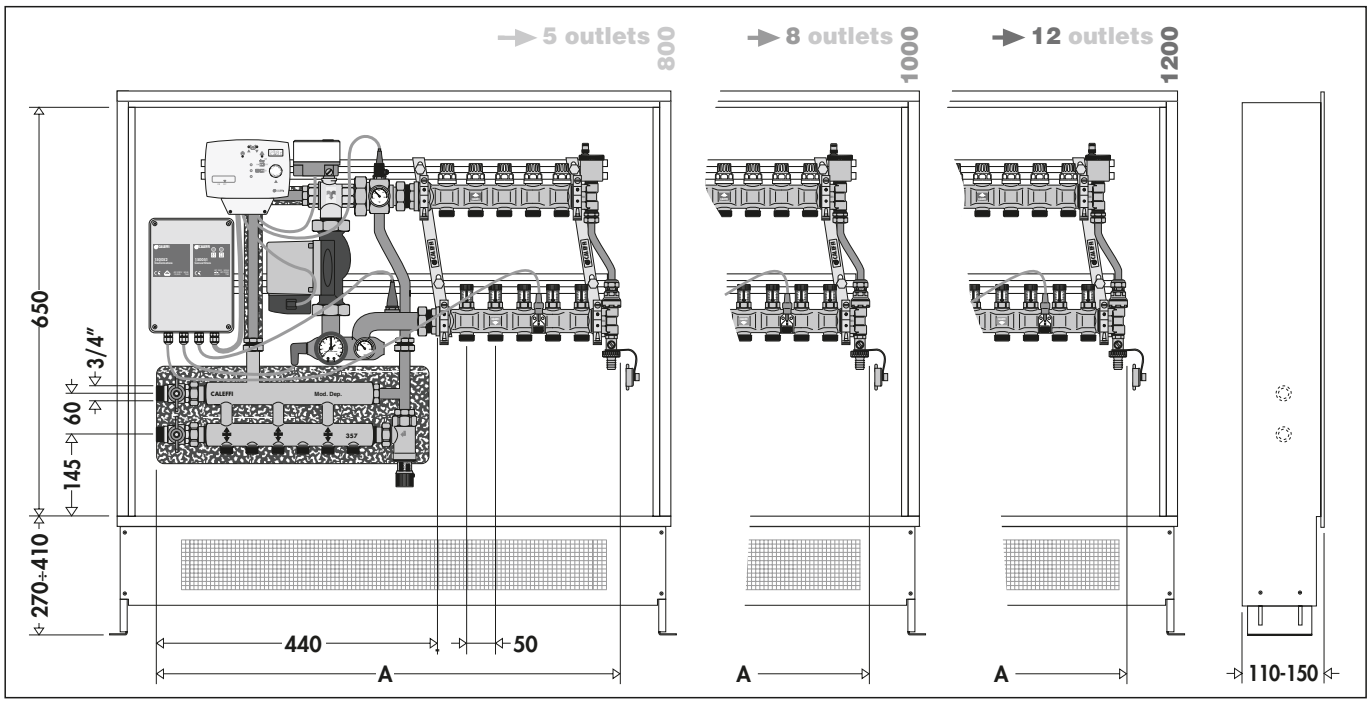
**Insulation**

| | |
|---|---|
| Material: | closed cell PEX foam |
| Thickness: | 15 mm |
| Density: - inner part: | 30 kg/m³ |
| - outer part: | 50 kg/m³ |
| Thermal conductivity (DIN 52612): | 0°C: 0,038 W/m·K |
| | 40°C: 0,045 W/m·K |
| Coefficient of resistance to the diffusion of vapour (DIN 52615): | >1.300 |
| Working temperature range: | 0 – 100°C |
| Fire resistance (DIN 4102): | B2 class |

**Dimensions**

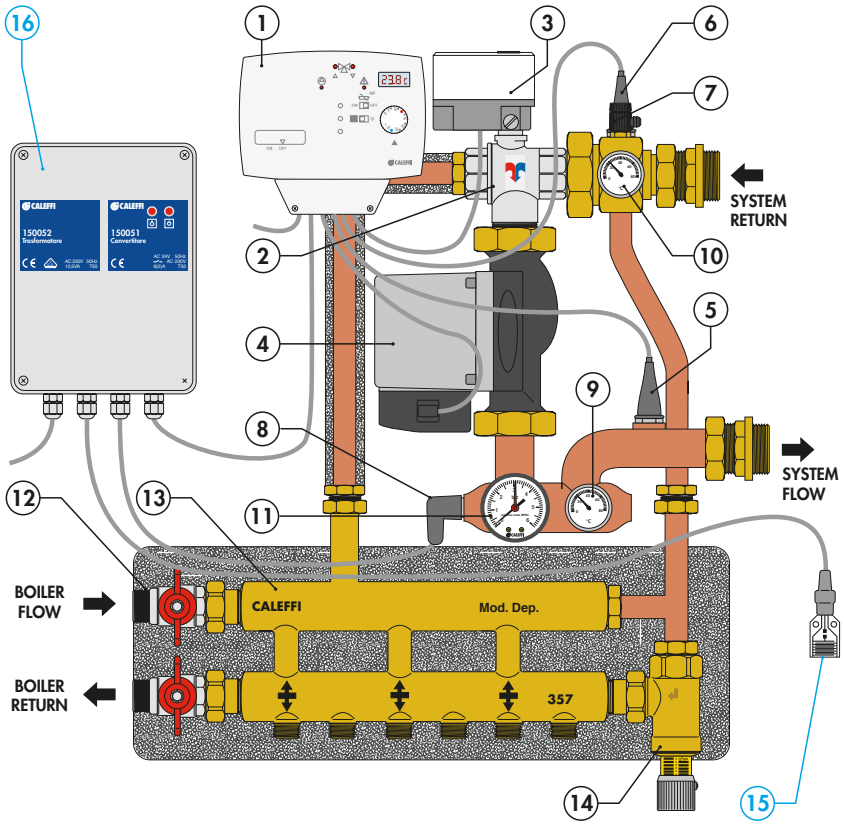



| Code | 161503 |
|---|---|
| A | 3/4" |
| B | 23 p. 1.5 |
| C | 60 |
| D | 1" |
| E | 240 |
| F | 75 |
| G | 87 |
| H | 50 |




| Code | 1615E2 003 | 1615F2 003 | 1615G2 003 | 1615H2 003 | 1615I2 003 | 1615L2 003 | 1615M2 003 | 1615N2 003 |
|---|---|---|---|---|---|---|---|---|
| Radiator outlets | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Panels outlets | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| A | 775 | 825 | 875 | 925 | 1015 | 1055 | 1105 | 1155 |

## Characteristic components

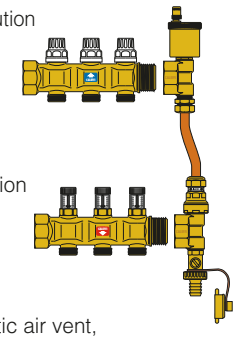



1 Digital temperature controller
2 Three-way ball valve
3 Three-point actuator
4 Three-speed pump: UPS 25-60
5 Flow temperature sensor
6 Return temperature sensor
7 Adjustable drain valve
8 Safety thermostat
9 Flow temperature gauge
10 Return temperature gauge
11 Pressure gauge
12 Primary circuit shut-off valves
13 High temperature distribution manifold
14 Differential by-pass valve
15 Max. RH% control sensor
16 Max. RH% control components

The regulating unit is preassembled with:

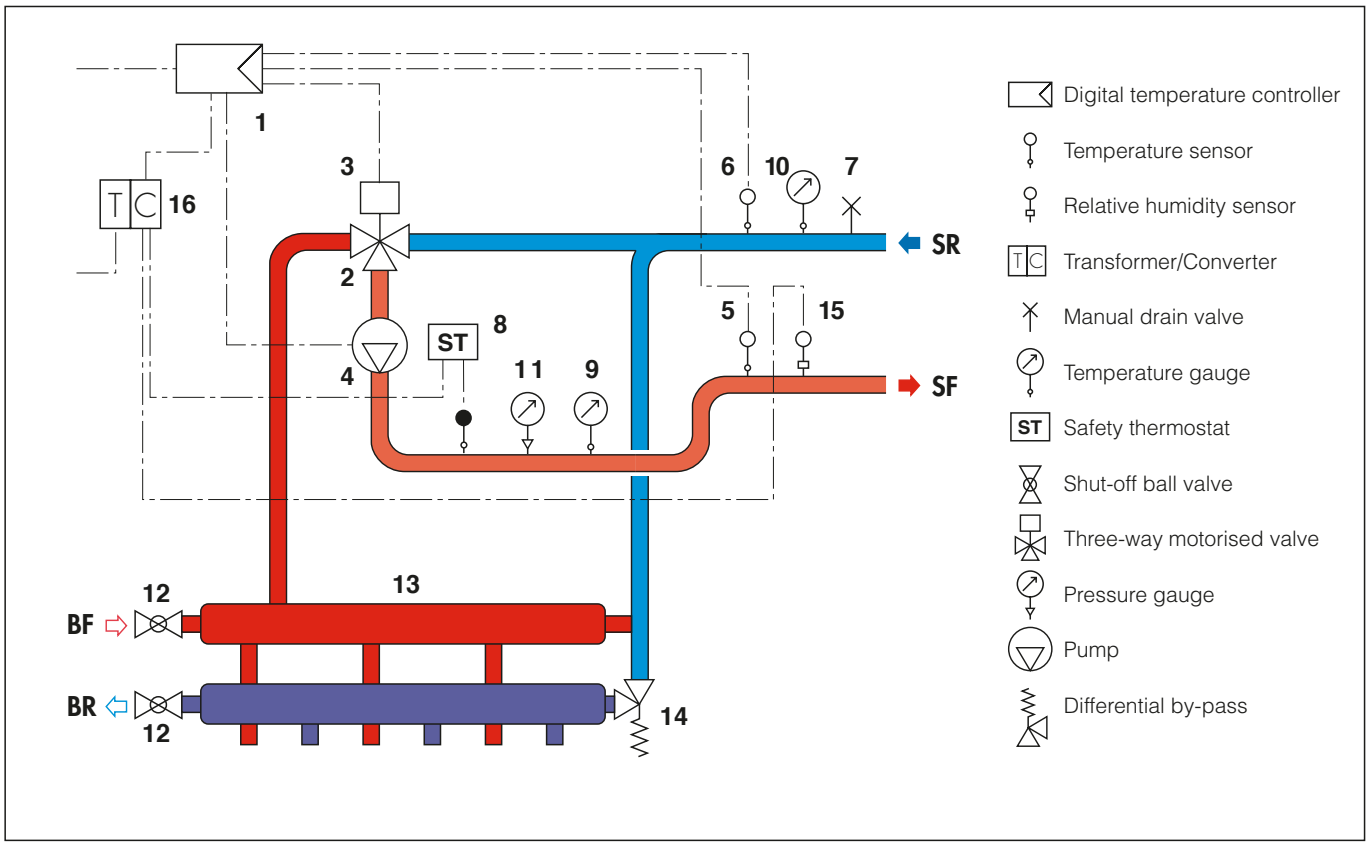
Series 666 return distribution manifold, equipped with shut-off valves on individual circuit specially designed for thermoelectric control.

Series 667 flow distribution manifold, equipped with micrometric valves for calibrating individual circuits.



Head units with automatic air vent, **differential pressure control by-pass kit** and drain valve.

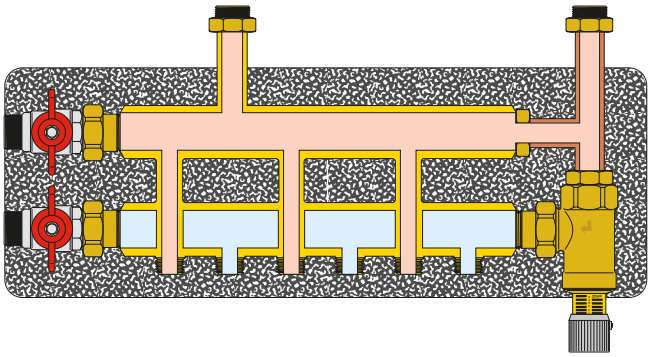
## Hydraulic diagram



## High temperature distribution kit

### Operating

The high temperature distribution kit distributes water to the heater or cooler units connected before the outlet to the secondary radiant panel circuit. It consists of a single sided dual manifold and a differential by-pass valve.



## High temperature distribution manifold

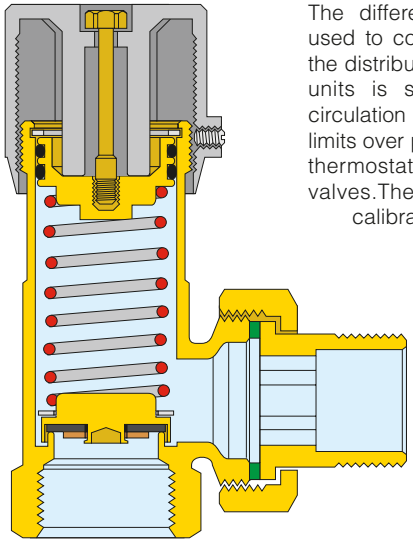
The distributor manifold not only distributes the water in the heater unit circuits **but also allows the hydronic separation between the primary and the secondary circuits**. This separation improves the functioning of the secondary circuit to the panels and prevents changes in the flow rate in the primary circuit from affecting the secondary circuit. In this case, the flow rate in the respective circuits is an exclusive function of the pump flow rate and the reciprocal influence arising from coupling them in series is avoided. Two possible conditions of circuit equilibrium follow.

A typical circuit design gives the following operating conditions:
$G_{primary} = G_{secondary}$ (inlet to the mixing valve) + $G_{heating\ units}$
$G_{primary}$ max. recommended: 1,5 $m^3/h$

### Manifold hydraulic characteristics

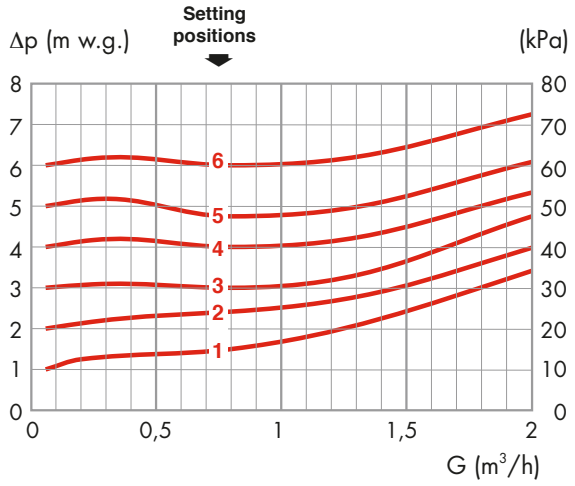
| | |
|---|---|
| Localised loss coefficient ξ inlet (F+R): | 3,0 |
| Localised loss coefficient ξ outlets (F+R): | 6,5 |

## Differential by-pass

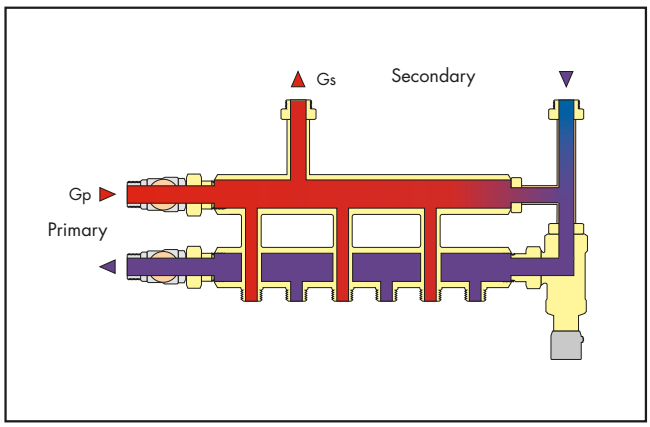


The differential by-pass valve is used to control the head to which the distribution circuit to the heater units is subjected; it facilitates circulation to the heater units and limits over pressure where there are thermostatic or electro-thermal valves.The differential valve is calibrated at the pressure loss value in the heater unit circuit.

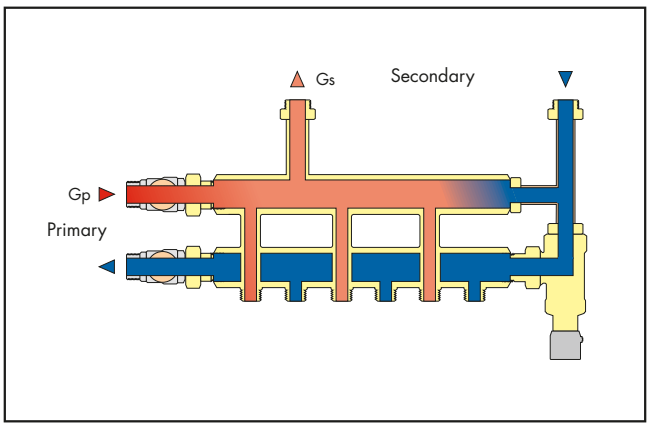
### Differential by-pass technical specification




*Factory setting: 10 kPa (1 m w.g.)*

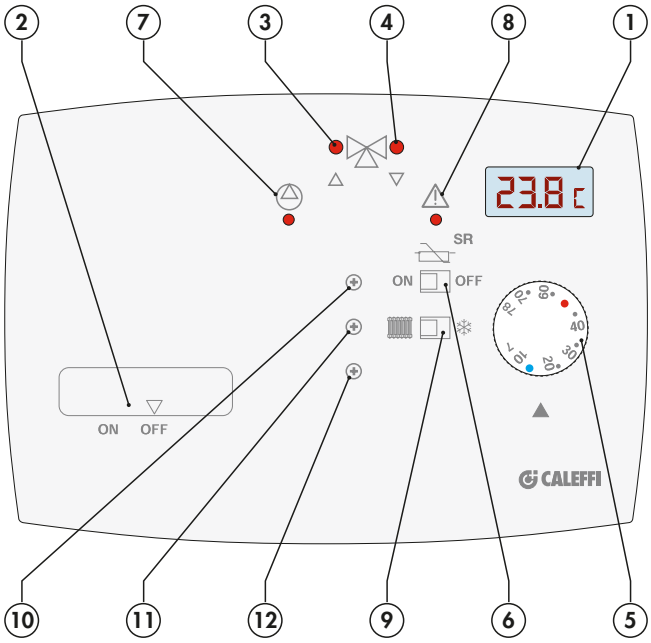



**Gprimary > Gsecondary**




**Gprimary < Gsecondary**

## Digital temperature controller




The front panel contains the following functions:

1) Three-digit LCD display for: temperature measured or calculated and setting programmed delays in the system.
   • Temperature range displayed: 0 – 99°C with a 0,1°C resolution.

2) Controller function selector On/Off.

3) Mixing valve on opening: Led on.

4) Mixing valve on closing: Led on.

5) Selector for setting flow temperature
   • Temperature range: 7 – 78°C
   *Factory setting:* *- heating: max. 50°C*
   *- cooling: min. 14°C*

6) Return sensor selector
   • Sensor off: OFF
   • Sensor on: ON
   *Factory setting:* ***ON***

7) Pump running (ON): LED permanently on

8) S.T. led - safety temperature. Permanently on when the limit signalled by the thermostat or humidistat is reached. It also comes on permanently if the flow/return sensors malfunction (see paragraph flow/return sensor).

9) Switch for changing heating/ cooling function.

10) Adjuster for maximum duration of impulse on valve.
    Adjustable 0,2 – 6 s. *Factory setting: 2,5 s.*

11) Adjuster for time delay in reading return sensor.
    Adjustable 1 – 360 s. *Factory setting: 20 s.*

12) Adjuster for valve-motor mechanical time delay.
    Adjustable 1 – 30 s. *Factory setting: 13 s.*

## Operation

The temperature controller receives the activation signal from the ambient thermostat to start the pump and operate the mixing valve. The controller operates the mixing valves according to two logic approaches depending on whether the return sensor is on or off.

**Set point regulation**: return sensor off. Selector 6) OFF.
In this case the flow temperature FT is held constant at the value set using the selector 5) both for heating and for cooling. The setting is shown on the display 1).

**Modulating regulation**: return sensor on. Selector 6) ON.
In this case the flow temperature FT is modified as a function of the temperature measured by the return sensor RT. This keeps the actual thermal output of the slab and as a consequence the ambient thermal load under control. The thermal response time of the system is thus reduced to a minimum.

$RT_{set} = FT_{set} - 35\% (FT_{set} - 20°C)$
$FT_{calculated} = FT_{set} + (RT_{set} - RT)$

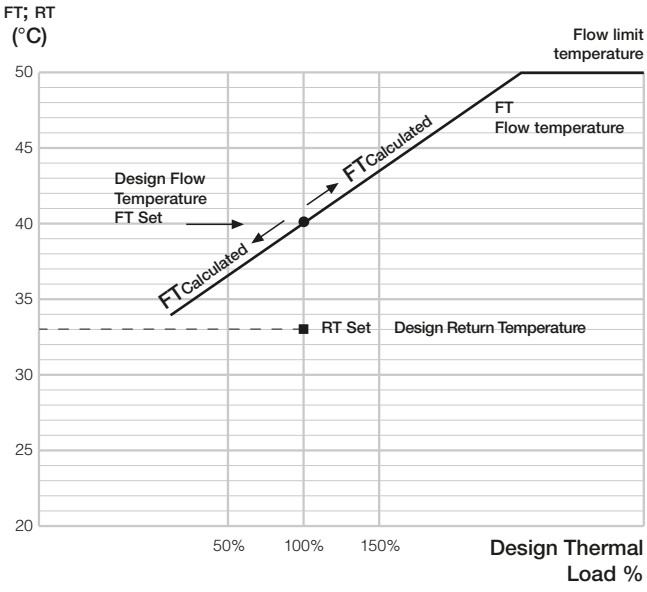
*Example:*
$FT_{set} = 40°C$
$RT_{set} = 40 - 0{,}35 \cdot (40 - 20) = 33°C$
$FT_{calculated} = 40 + (33 - RT)$

The new FT value calculated is given on the display 1) with a small side bar showing.


Each time the FT is calculated, the actual FT is displayed for 5 s, after which the new FT calculated is shown. Changes to FT stop when RT reaches $RT_{set}$.

The return sensor is switched off for the cooling function.

## Curve correction with return sensor

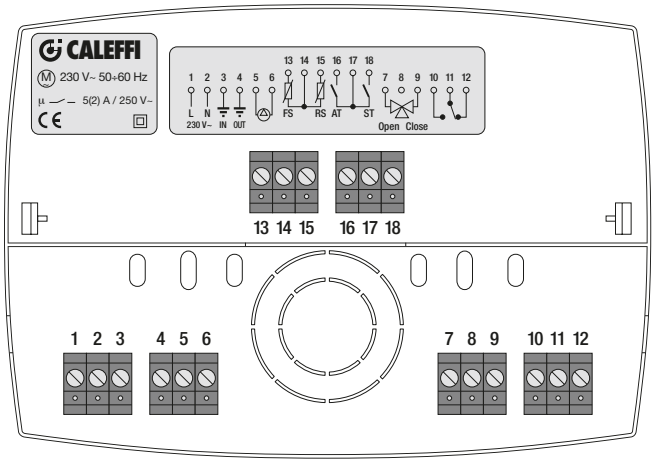


### Display

The three-digit LCD display shows the following parameters:

- flow temperature set using the selector 5). The flow temperature measured appears after 5 seconds.
- the flow temperature measured with the return sensor off.
- the flow temperature calculated with the return sensor on.
- the maximum duration of the impulse to the valve, selected using the adjuster 10). Displayed for 5 seconds.
- delay time for acquiring the return temperature, selected using the adjuster 11). Displayed for 5 seconds.
- valve-motor mechanical delays, selected using the adjuster 12). Displayed for 5 seconds.

### Back panel




The terminals for the various electrical components are located on the back panel.

Electric supply
1 Supply 230 V~ “live”
2 Supply 230 V~ “neutral”
3 Earth

Pump control
4 Earth
5 Pump control 230 V~ “live”
6 Pump control 230 V~ “neutral”

Mixing valve control
7 Valve control on opening
8 Common C
9 Valve control on closing

Auxiliary micro-switch
10 Auxiliary outlet NA
11 Common outlet C
12 Auxiliary outlet NC

Flow/return sensor
13 Flow temperature sensor
14 Common C
15 Return temperature sensor

Ambient thermostat/safety thermostat
16 Contact for ambient thermostat
17 Common C contact for ambient thermostat / common C contact for safety thermostat and humidity sensor converter
18 Contact for safety thermostat and humidity sensor converter

### Heating safety thermostat

If the safety thermostat signals a flow temperature greater than 55°C the following state is set: pump OFF, mixing valve closed. The thermostat terminal is NC; if it is not connected, the temperature controller is set off.

### Auxiliary micro-switch

The controller is equipped with an auxiliary micro-switch which can be used to control other equipment.

Example:
For Heating: to switch the boiler on or off. Terminal NA- pump off-ambient thermostat OFF or safety thermostat ON (boiler off).
Terminal NC-pump on-ambient thermostat ON (boiler on).
For Cooling: to switch chiller unit on or off.
Terminal NA-pump OFF-ambient thermostat OFF or RH% limit sensor on (chiller unit OFF).
Terminal NC-pump ON-ambient thermostat ON (chiller unit ON).
Contacts rating: 5 A (230 V).

### Flow /return sensor

The flow/return temperature sensors are of the NTC type. If the sensor detects electrical resistance that indicates a short circuit, the following operating state is set: pump OFF, mixing valve closed, LED 8) permanently on.

### Table of sensor resistance values

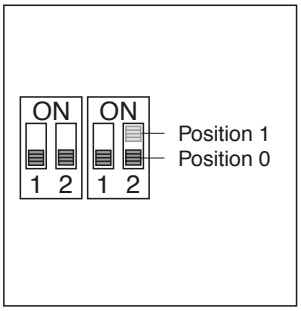
| °C | Ω | °C | Ω | °C | Ω | °C | Ω | °C | Ω |
|---|---|---|---|---|---|---|---|---|---|
| -20 | 97.060 | 10 | 19.903 | 40 | 5.327 | 70 | 1.752 | 100 | 680 |
| -15 | 72.940 | 15 | 15.714 | 45 | 4.370 | 75 | 1.480 | 105 | 592 |
| -10 | 55.319 | 20 | 12.493 | 50 | 3.603 | 80 | 1.255 | 110 | 517 |
| -5 | 42.324 | 25 | 10.000 | 55 | 2.986 | 85 | 1.070 | 115 | 450 |
| 0 | 32.654 | 30 | 8.056 | 60 | 2.488 | 90 | 915 | 120 | 390 |
| 5 | 25.396 | 35 | 6.530 | 65 | 2.083 | 95 | 787 | 125 | 340 |

### Flow temperature limit for heating or cooling

Maximum heating and minimum cooling flow temperatures can be set with the controller. Dip switches are located on the back of the temperature control panel for this purpose. Different switch configurations give different limit temperatures.
*Factory setting:* *- heating: max 50°C*
*- cooling: min 14°C.*

### Table of temperature limit dip switch positions

| Dip switch setting | | | | Maximum limit (°C) | Minimum limit (°C) |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 50 | 14 |
| 0 | 0 | 1 | 0 | 54 | 13 |
| 0 | 1 | 0 | 0 | 58 | 12 |
| 0 | 1 | 1 | 0 | 62 | 11 |
| 1 | 0 | 0 | 0 | 66 | 10 |
| 1 | 0 | 1 | 0 | 70 | 9 |
| 1 | 1 | 0 | 0 | 74 | 8 |
| 1 | 1 | 1 | 0 | 78 | 7 |




### Maximum cooling temperature limit

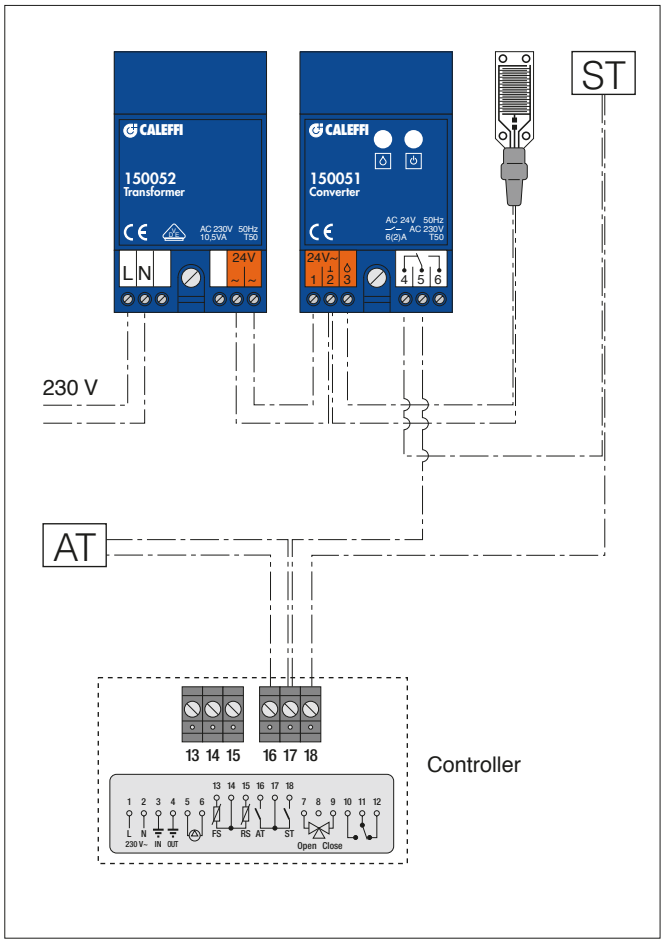
Cooling flow temperature cannot be set greater than 25°C.

## Control of relative humidity

When the temperature controller is used for cooling, the relative humidity sensor must be used. The function of this sensor is to detect the maximum relative humidity limit in order to prevent the formation of condensation in the cooling thermal slab. It is set at RH=80-85%. When this level is reached the following operating state is set: pump ON, mixing valve closed.

## Connection of the humidity sensor

The humidity sensor is connected to the temperature controller through a special transformer and converter.

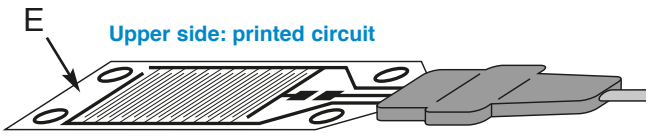



## Testing the humidity sensor

The functioning of the sensor must be checked at the start of each cooling season by placing a damp wad of cotton wool on the surface; this should cause the mixing valve to be switched off and switch on the red LED, 8), on the front of the control panel.

## Location of the humidity sensor

The humidity sensor is located at the point where humidity is most likely to form which will depend on the system design. It is positioned with the carbon printed surface facing upwards as in the diagrams.




**Inferior side: placed 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. Fix by inserting the two straps contained in the package through the holes in the sensor.

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

- Minimum flow temperature can be set using the selector 5) on the front panel.
- Maximum RH% limit, controlled through RH% sensor.
- Room temperature controlled through room thermostat.
- Room temperature and relative humidity controlled through a dedicated fan-coil or dehumidifier).

**N.B.:** Through the RH% limit sensor, possible formation of condensation is anticipated. **In areas with cooling, adequate air treatment must always be present.**

## Accessories

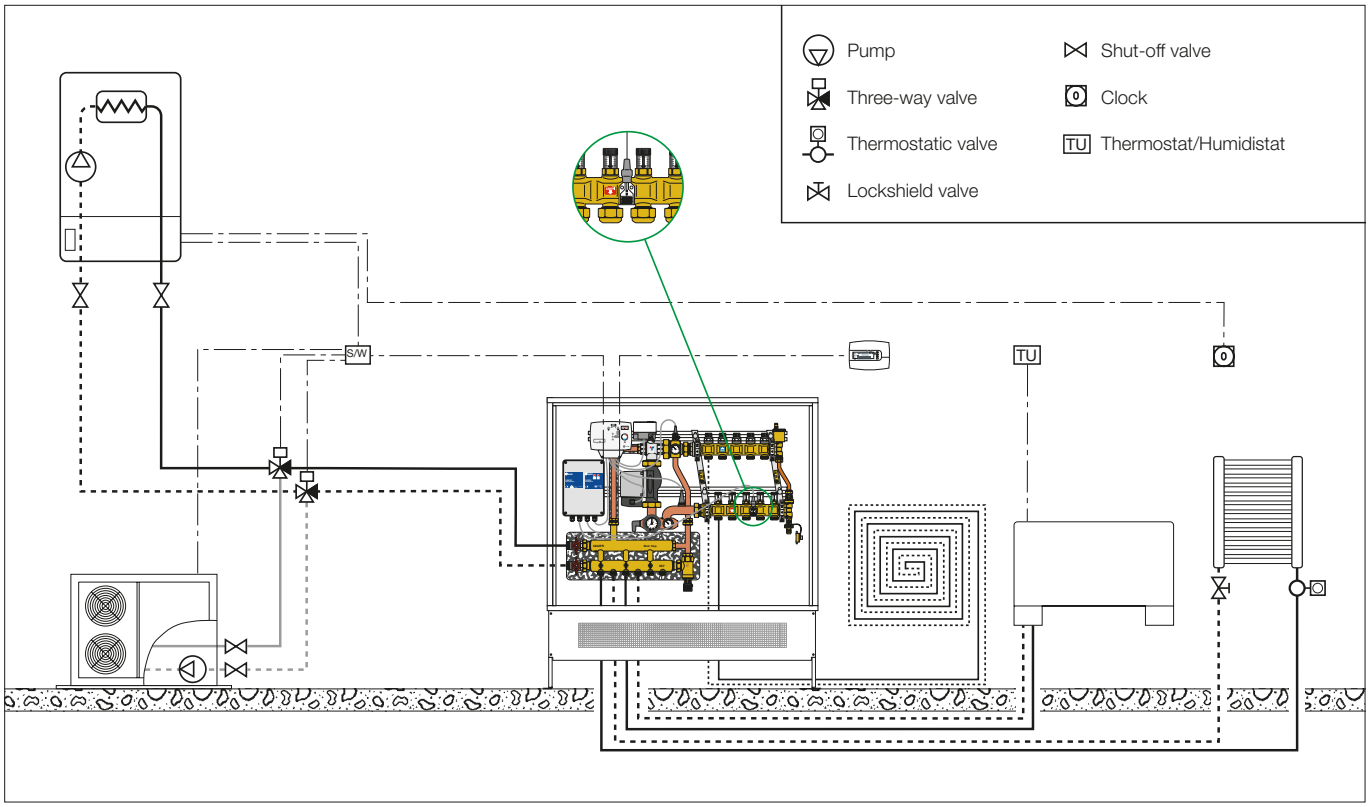
### 738 •

Ambient chrono-thermostat, battery operated.
**With self-learning programme.**
Weekly programmable clock.
Suitable for phone programmer.
Three temperature levels.
Minimum programming: 30 minutes.

CE

| Code | |
|---|---|
| **738**107 | 120 x 90 x 20 mm |

**Application diagram**




## SPECIFICATION SUMMARIES

### Code 1615.2 003

Modulating temperature regulating unit for heating and cooling with piping in polished copper. 3/4" M connections to primary circuit. 3/4" M distribution manifold outlets to radiant panels. 23 p.1,5 connections high temperature distribution manifold outlets. Primary inlet temperature range: 5 – 90°C. Maximum working pressure: 10 bar. Complete with: three-way ball valve; three-point actuator, electric supply: 230 V, protection class: IP 54; radiant panel system temperature controller, electric supply 230 V, setting temperature range: 7 – 78°C, complete with flow, return and relative humidity sensors; three-speed pump UPS 25-60, protection class: IP 44. Adjustable drain valve; safety thermostat, working temperature range: 55°C±3°C, protection class: IP 55; Scale temperature gauge: 0° to 80°C; scale pressure gauge: 0 to 6 bar; primary circuit shut-off valves; 5-outlet (5 to 12) flow manifold for panel systems complete with micrometric preregulation valves and drain cock; 5-outlet (5 to 12) return manifold for panel systems complete with shut-off valves suitable for thermoelectric controls and air vent valve; by-pass kit for panel system manifold, setting: 25 kPa (2500 mm w.g.); flow and return single sided dual manifold for high temperature circuit; by-pass valve for high temperature manifold, setting: 10 – 60 kPa; supplied preassembled in coated steel sheet box with lock, adjustable depth: 110 to 140 mm, complete with adjustable height 270 to 410 mm floor supports.

### Code 161503

High temperature distribution kit for modulating temperature regulating unit consisting of: flow and return single sided dual manifold for high temperature circuit. 3/4" F with union connections to primary circuit; 23 p.1,5 outlet connections; by-pass valve for high temperature system manifold, setting: 10 - 60 kPa. Maximum working temperature: 100°C. Maximum working pressure: 10 bar.



CALEFFI

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