# Technical terms

## Bimetal sensing element:

Generally speaking, thermal bimetal sensing elements consist of layers of different metals or alloys of almost the same thickness that are firmly connected with each other. These metal or alloy strips possess different thermal expansion qualities. This is why the bimetal strip curves at temperature changes in such manner that a hollow curve is formed at the side at which the layer with the lower thermal expansion exists. The heat needed for the operation of the bimetal strip or bimetal sensing element is transferred either via thermal conduction, radiation or heat dissipation from the surroundings (indirect heating).

## Break contact (bimetal):

Break contact (bimetal): This control contact opens at rising and closes at falling temperatures (for “heating”).

## Make contact (bimetal):

Make contact (bimetal): This control contact closes at rising and opens at falling temperatures (for “cooling”).

## Changeover contact (bimetal):

Defines as a changeover switch with both break and make contact. The functions are the same as explained above with regard to the break and make contacts.

## Switching difference (hysteresis):

The hysteresis defines as the time difference between the activation and deactivation of the controller heating system or of the controller itself.
Usually, a difference is to be made between the following:
a) The controller related switch temperature difference: This switch difference depends on the design of the device.
b) The room related switch temperature difference: This switch difference depends on the behaviour of the controlled overall system, i.e. on the floor structure, the impact of foreign heat sources, the place of installation of the controller and of the controller itself.
The switch temperature difference relates always to the controller and it indicates not the switch temperature difference that actually arises as a result of the controlled overall system. The switch temperature varies in dependence on the place of operation and the conditions that prevail at this particular spot. The temperature that prevails within a certain room is always subjected to certain variations. These variations result as a consequence of different factors, such as the switch temperature difference of the controller itself, the characteristics of the room that needs to be controlled like, for example, the heating up speed, the actually occurring heat loss, etc.

## Thermal recirculation / thermal feedback:

The controller is switched off in good time in the heating process by means of an additional built-in heating resistor.
This prevents room temperature from overshooting and, as a result, there is a smaller switching differential.

## Temperature decrease:

The temperature decrease is, just as explained earlier above with regard to the thermal recirculation or thermal feedback, realised by means of a special resistor. The actuation of this resistor is effected either manually by means of the manual operation of a switch or through the operation of a switch clock. Once actuated, a temperature is simulated to the bimetal sensing element that is by 4 K higher than the temperature that actually exists inside the related room. If the controller has, for example, been set to 20 °C, the temperature can consequently decrease by 4 K down to max. 16 °C. In the event the temperature decreases down to a point below that, the heating system is activated and deactivated again at a temperature level above 16 °C. The level of the decrease temperature actually to be realised depends on different factors, such as the quality of the heat insulation of the related building and the desired temperature decrease time (for example one night, one weekend, holidays or similar).

## Mechanical range suppression:

The mechanical range suppression is realised by means of so-called setting pins or setting elements (red / blue) that exist underneath of the related adjusting knob. They enable to restrict the temperature setting range mechanically. An unintended misadjustment of the corresponding set values in, for example, children‘s rooms or public buildings can thus be prevented.

## Proportional band (p-band):

The so-called proportional band defines as the zone of the input variable within which the controller delivers a continuous output signal. This means that, within this proportional band, the controller maintains the room temperature continuously at nearly always the same level (provided however that the available calorific output of the heating system is sufficient).

## Neutral zone:

The so-called neutral zone defines as the control range within which neither any heating nor any cooling operation takes place.

## Defrosting:

Defrosting defines as de-icing or heating up of the heat exchangers or cooling units. Defrosting is needed in order to ensure that the system is maintained in a condition that allows to operate it efficiently.

## Air conditioning system: 2-pipe fan convector (fan coil unit):

2-pipe air conditioning systems are, in dependence on the requirements, supplied through the same pipe system either with heating or with cooling water (forward and return flow).

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## Air conditioning system: 4-pipe fan convector (fan coil unit):

4-pipe air conditioning systems are, in dependence on the requirements, supplied through one heating or cooling circuit each with heating or cooling water (4-pipes).

## Heat pumps:

Use of heat pumps as air conditioning systems: Modern heat pumps can be used for both the cooling and heating of rooms. As processes can be inversed in a reversible manner when using modern systems, they can be utilised for the execution of heating and cooling operations.

## Cooling ceilings:

Cooling ceilings count among the group of systems that are usually described as surface air conditioning systems. Often, cooling ceilings are being applied in offices for passive cooling purposes. To enable this, cool water (mostly of a temperature of 16 °C) is being conveyed through a network of small tubes to the result that the air in the room is cooled down. Deeper flow temperatures can, on account of the risk of the formation of defrost or condensed water.

## Reversing valves:

Reversing valves (four-way valves) enable to realise a reversing cycle. The condenser is, in the course of this cycle, used as vaporiser in such manner that the cooling unit is getting warmer and is thus being defrosted.

## Vaporisers / condensers (liquefiers):

A liquefier or condenser is a heat conveyor, which is used in refrigeration systems inside of which a medium, through the dissipation of heat, is being liquefied that is in the vapour state. Usually, the coolant is cooled down in the condenser to a much lower temperature level. The condenser used in refrigeration system is, in order to distinguish the term from the one used in German language to define an electrical capacitor (“Kondensator” in German in both cases), termed in German as a so-called “liquefier”. As the liquid medium is being vaporised in it through the supply of heat, the vaporiser by contrast causes exactly the opposite process.

## Split- and multi-split type air conditioners:

Split type air conditioners consist of at least two heat exchangers, one of which is installed inside the room that is to be cooled. This heat exchanger operates as vaporiser, while the other is used for the dissipation of the absorbed heat. Most of the currently applied split type air conditioning systems enable the operation in inverse mode, scilicet can be also be used for the heating of the related rooms in the event the supply of heat was required. So-called multi-split type air conditioning systems consist of several vaporisers that are all connected to one condenser (liquefier).

## PWM (pulse width modulation):

Procedure for the generation of a quasi-continuous transfer behaviour of a controlled system. The time constant associated with a certain transmission path is influenced by the variation of the duty cycle at the path input in such manner that a quasi-continuous signal form is being created at its output.

## Actuating drives / actuators:

Explain as electrically addressable valves for the control of, for example, the passage of warm water through a heating system. Usually, one distinguishes between so-called ON / OFF and proportional actuators. Proportional valves are used for the connection of controllers the control behaviour of which is quasi-continuous.

## Continuous controllers:

These controllers deliver an analogue output signal. The value of the analogue output signal varies continuously, scilicet without any discontinuities in dependence on the output signal.

## Two-point control procedure (ON / OFF control procedure):

Explains as a so-called control algorithm that, for example upon the transgression of the set temperature, effects the deactivation of the system and causes its reactivation once the set temperature is being underrun. Both the room and the temperature inside of it are always subject to certain variations (control deviations). These variations are a consequence of the typical switching difference of the controller and the characteristics of the related room, such as the required heating up speed, the heat loss actually occurred, etc.

## Three-point control:

Three-point controllers enable to perform control operations in or between the three operating modes “heating”, “neutral zone” and “cooling”.

## Switching differential and hysteresis

Differential between switching the heating or the controller on and off.
The indicated switching differential always refers to the controller. It does not indicate the actual hysteresis of the room temperature. This varies, depending on the place of operation and the prevailing conditions. The temperature in the room is always subject to fluctuations. These fluctuations are a consequence of the switching differential of the controller, the characteristics of the room, e.g. the heating speed, heat loss, etc., and the respective disturbance variables.