

Controller for the triggering of EC fan coils with "ECO" contact input or frost protection monitoring after "device OFF"

Safety information

Expert electricians only may open this device in due compliance with the wiring diagram shown in the housing cover / on the housing / represented in the corresponding operating instructions. All expert electricians charged with the execution of such works must comply with the relevant safety regulations currently operative and in force. **Caution!** The operation of the controller in the vicinity of other devices that do not comply with the EMC directives may affect its functions. The company charged with the installation of the device must, after the completion of the installation works, instruct the user of the control system into its functions and in how to operate it correctly. These operating instructions must be kept at a place that can be accessed freely by the operating and/or servicing personnel in charge.

1. Application

This air-conditioning controller has been specially devised for the control and triggering of EC fan coils, EC fan coil units and other air-supported EC air conditioning systems used with valve-equipped 2- or 4-pipe systems (normally closed valve types). The device is suited for use as internal sensor-equipped single room temperature controller or, in combination with a remote sensor, as external control device. Regarding other applications not to be foreseen by the manufacturer of this device, the safety standards concerning these applications need to be followed and adhered to. Regarding the suitability of the device for such applications, please refer to section 8, herein.

2. Functional description

The switching difference of the controller comes to approx. 0.5K. The calculation of the control characteristics specified hereafter by way of example bases on an expected control deviation of the controlled system of 1K and a set ECO temperature difference of 2K (see section 3.2).

2.1 Application in 2-pipe systems with either manual or automatic heating/cooling changeover

The switch S3 (see section 7.) enables to adjust the controller to the existing pipe system. If using it for the control of 2-pipe systems (factory setting), the output at terminal 6 triggers the heating/cooling valve. The heating/cooling changeover contact (terminals 11 and 12) determines the direction of operation controlled by the device. Contact closed = heating, contact open = cooling. Optionally, a flow sensor (see sections 4. and 5.) can be connected in place of the contact, which allows to achieve the automated changeover between heating and cooling mode. Regarding the changeover points when using a flow sensor, please refer to section 5.

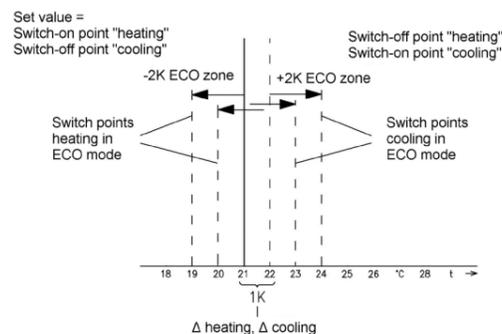
Control characteristic during operation in heating mode

The heating is being activated each time the temperature falls below the adjusted set value. As soon as the temperature rises by a value that corresponds to the switching difference of 1K, the heating is being deactivated again. This ensures that the actual temperature will not fall below the adjusted desired temperature value, thereby maintaining an optimal comfort level.

Control characteristic during operation in cooling mode

Cooling is deactivated each time the temperature attains the adjusted value. As soon as the temperature rises by a value that corresponds to a switching difference of approx. 1K, the cooling is being activated again.

Switch point in 2-pipe systems (heating or cooling)



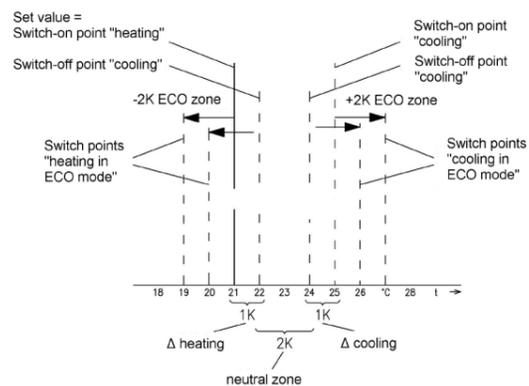
2.2 Application in 4-pipe systems

The switch S3 (see section 7.) enables to adjust the controller to the existing pipe system. If using it for the control of 4-pipe systems the heating output at terminal 5 triggers the heating operations and the cooling output at terminal 6 the cooling operations.

Control characteristic when operating with neutral zone

The neutral zone corresponds to 2K and begins at the heating switch-off point. If set to 21°C, the heating will be set to a temperature above 21°C while operating in heating mode and down to a temperature below 25°C while operating in cooling mode. In both heating and cooling mode, the switching difference comes to approx. 1K. If set to 21°C, the heating switch-off point is thus at approx. 22°C and the cooling switch-off point at approx. 24°C.

Switch points in 4-pipe systems (heating, neutral zone, cooling)



2.3 Luminous indications during control operation

A lamp below the setting mark indicates the current control condition.

Blue = cooling (controller requests cold)

Yellow = heating (controller requests heat)

Yellow with the switch set to = antifreezing protection

Blinking red = breakdown of the external sensor or sensor short circuit (see section 2.9).

2.4 Option to select between internal or external sensor-based operation

The selector switch S4 (see section 7.) enables to set the device for either the utilisation of the internal (factory setting) or the external sensor. The terminals 7 and 8 have been provided for the connection of the external sensor. For a selection of suitable sensors, please refer to sections 4. "Accessories", and 6. "Data table with external sensor data (characteristic curve)".

2.5 Fan function

The 0 ... 10V output available via the terminals 9(+) and 10(-) at this device allows to connect electronically commutated fans (EC fans). The operating mode selector switch enables to select between two fan modes.

If the selector switch has been set to , the fan speed can be selected using the 3-level switch provided for this purpose.

If setting the selector switch to , the fan auto-adjusts itself to a speed that depends on the difference between set and actual temperature and the adjusted proportional band (see section 3.2). The switch S2 (see section 7.) allows to select either the fan function "turn-off delay off" (factory setting) or "turn-off delay on". Once the fan function "turn-off delay" has been selected, the fan will, each time after the deactivation of the heating or cooling output, perform a 10-minute after-run.

2.6 Standby function

Setting the operating mode selector switch to deactivates all control operations. Once the control operations have been deactivated this way, the frost protection function is active.

2.7 Antifreezing function

The antifreezing function protects the controlled room against cooling down thoroughly and thus against frost damages due to it. In the event the temperature measured by the activated internal or external sensor falls below a value of approx. 5°C, the valve output "heating" within the controlled 4-pipe system is activated. In 2-pipe systems, the same applies with regard to the valve output "heating/cooling", which is activated along with the fan output. The controller is deactivated again, once a temperature of 6°C is being exceeded.

2.8 Contact inputs ON/OFF – ECO

The following function can be triggered via the terminals 13 and 14 (safety extra low voltage) depending on the position of the switch S1 (see section 7.): switch S1 set to "ON" (factory setting) → ECO function (energy economizing function). The triggering of the energy economizing function is effected by an external contact (terminals 13 and 14). Once this function is activated, the temperature is, while operating in heating mode, being set to a temperature that, in relation to the set value, is by a value lower that corresponds to the difference in temperature between the set and the ECO temperature value and, while operating in cooling mode, to a temperature that transcends the set value by this difference value. When controlling 4-pipe systems, the neutral zone of 2K is being extended by double the difference in temperature between the set and ECO temperature value, once the ECO function has been triggered. If, for instance, the ECO function is triggered after adjusting a set value of 21°C, the control operations performed by the system in heating mode aim at reaching a temperature of 19°C and at reaching a temperature of 27°C while operating in cooling mode (see sections 2.1 and 2.2). This enables to save energy in a room- and/or floor-wise manner. The ECO function is mainly used in hotels where, apart from the saving of energy, the standby function is necessary in order to hand over the room to the hotel guest in a neither too warm nor too cold condition and the well-being temperature shall be attained in this room as soon as possible after it has been occupied by a guest. It is impossible to bring the system to perform control operations aimed at reaching temperatures below a level of 5°C by setting the temperature to a minimum value and triggering the ECO function. Contact closed = normal operation, contact open = operation in ECO mode. Switch S1 set to "OFF" → ON/OFF function (antifreezing function). An external contact (window contact or timer, f. ex.) connected to the terminals 13 and 14 enables to deactivate the control operations performed by the system from a distance. Contact closed = control system activated, contact open = control system deactivated.

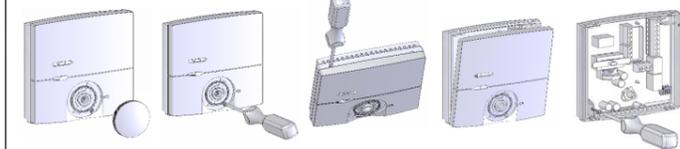
2.9 Emergency operation in the event of a sensor breakdown or sensor short-circuit

The emergency operation shall avoid the occurrence of critical temperature conditions in the room to be controlled if a breakdown or short-circuit of the activated sensor occurs. Once this is the case, the heating/cooling valve output in 2-pipe systems and the heating valve output in 4-pipe systems is, independent of the position of the operating mode selector switch, being triggered at a level that is equivalent to 30% of the normal operating time (3 minutes ON, 7 minutes OFF). A setting mark blinks red to signal that the emergency mode is active. The fan output is activated once the fan level 3 has been set. The related room is thus prevented from cooling down thoroughly, thereby ensuring its protection against frost damages.

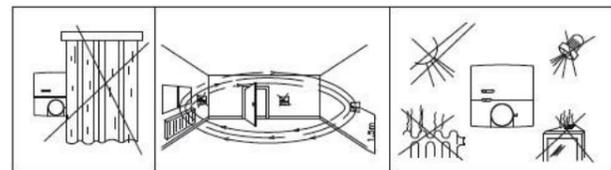
3. Installation / mounting

The device is, depending on its size, either delivered in closed, or, in order to facilitate its installation, in opened condition. After its installation on the wall or on an UP box, its electrical connection and the **safe separation between mains voltage and safety extra low voltage using the enclosed partition** (see section 7.), the housing cover needs to be closed by hooking the lower hooks in the housing and folding the cover upward until it clicks into place. Following this, the housing cover should be secured using the accompanying screw. **Caution:** The device must not be mounted on electrically conductive surfaces. When using an external sensor, care must be taken to ensure that the sensor line is not laid in parallel to line voltage carrying cables or lines. Where parallel laying cannot be avoided, a shielded line is to be used and the shielding to be connected to the terminal 8, 12 or 14. In order to ensure the easy replacement of a defective sensor, the sensor including its line needs to be laid inside an empty conduit in a replaceable manner.

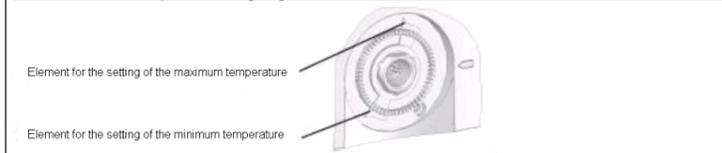
The controller is determined for wall mounting or installation on an UP box and must not be exposed to direct heat or cold sources. Also care must be taken to ensure that the device is not exposed to the influence of foreign heat or cold sources that warm or cool the device at its back (through air flows in cavity walls or the temperatures radiated by ascending pipelines, f. ex.).



Remove the button Loosen the screw Press the upper hooks inwards Open controller Screw the controller on



3.1 Limitation of the temperature setting range



The mobile setting elements underneath of the control knob enable to delimit the setting range of the controller mechanically. For this purpose, remove the control knob and set the stops as required (red stop for maximum temperature and blue stop for minimum temperature). Once this has been done, the control knob can be put on again.

3.2 Parameter setting function

Actuating the push button on the left side of the housing using a suitable object allows starting the parameter setting procedure. Once this function has been activated successfully, an LED blinks below the setting mark in dependence on the actual setting of the three-position operating mode selector switch. The different switch settings have the following effects:

Switch setting setting of the ECO temperature difference – LED blinks red

Switch setting setting of the output voltages required for the triggering of the individual fan levels – LED blinks blue. The blinking rhythm depends on the associated fan level.

Switch setting setting of the proportional band – LED blinks yellow

Basically, the following is applicable:

- Values will be changed only after adjusting the set point value generator. If, at the beginning of the parameter setting procedure, the set point value generator is in the correct position, this position has to be changed first and then readjusted.
- Once the device operates in parameter setting mode, both the operating mode selector and the slide switch allow to toggle between the individual settings. The adjusted values are being cached.
- Actuating the push button on the left side of the housing terminates the parameter setting procedure (until LED stops blinking).
- All changed values are being imported and the control operations performed based on these data.
- If the parameter setting function is not terminated actively, the parameter setting mode will be terminated automatically 120 seconds after the last action took place (change of the set point, change of the switch positions) and the control operations resumed based on the previously set parameters. All settings possibly made prior to such an automatic termination will be rejected.

Setting of the ECO temperature difference value (1 - 6K)

Set the operating mode selector switch to (LED blinks red). Turning the adjusting knob allows to set the ECO temperature difference now. The adjusted value corresponds to the numerical value imprinted on the adjusting button divided by five (factory setting 2K).

Setting of the output voltages required for the triggering of the individual fan levels

(1.0 ... 4.0V, 4.0 ... 7.0V, 7.0 ... 10.0V)

Setting the operating mode selector switch to allows to set the different output voltages as needed (LED blinks blue).

Sliding the slide switch to the position sets the speed of "fan level 1". The LED blinks thereby with a frequency of approx. 1Hz.

Sliding the slide switch to the position sets the speed of "fan level 2". The LED blinks thereby with a frequency of approx. 2Hz.

Sliding the slide switch to the position sets the speed of "fan level 3". The LED blinks thereby with a frequency of approx. 4Hz.

The output voltage required for the triggering of the desired level can now be changed using the setting knob. The required voltage is present at the terminals 9 and 10 (factory settings: 2.5V, 5.5V, 8.5V).

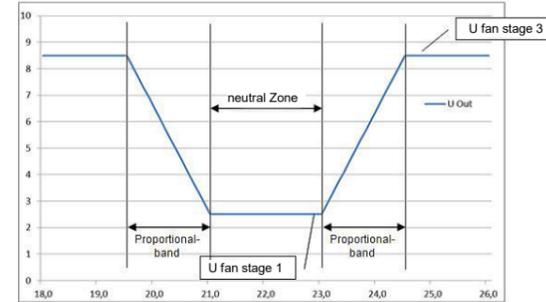
	Output voltage Fan level 1	Output voltage Fan level 2	Output voltage Fan level 3
	1V	4V	7V
	1,6V	4,6V	7,6V
	2,2V	5,2V	8,2V
	2,8V	5,8V	8,8V
	3,4V	6,4V	9,4V
	4V	7V	10V

Setting of the proportional band (0.5 ... 3K)

The operating mode selector switch needs to be set to first (LED blinks yellow).

Turning the adjusting knob allows to set the proportional band as required.

The adjusted value corresponds to the numerical value imprinted on the knob divided by ten (factory setting 1.5K).



Dynamic control of the air flow in controlled 4-pipe systems based on default parameters and a set temperature of 21°C.

Resetting the device to the factory settings

Actuating the push button on the left side of the housing for 5 seconds while operating in parameter setting mode allows resetting all previously made settings and restores the factory settings. The LED flashes for 5 seconds and its colour alternates slowly between blue and yellow (approx. 2 times per second) to indicate the successful restoration of the factory settings. If stopping to actuate the push button prior to the expiry of this 5 second time, the parameter setting procedure will be terminated without restoring the factory settings.

4. Accessories

- Flow sensor for changeover between heating and cooling (changeover sensor): KF-2 (sleeve sensor) or ALF-2 (contact sensor).

- External temperature sensor KF-2 (sleeve sensor) or BTF2-C47-0000 (room sensor for surface installation)

5. Technical data

Operating and switching voltage: 230V~

Outputs:

Heating: relay make contact, max. 5(1)A / 250V~, type 1.B

Cooling: relay make contact, max. 5(1)A / 250V~, type 1.B

Analogue output: 0-10V (SELV), max. 5mA, for fan triggering

Level switch equipped fan: 3 level switch: 2.5V, 5.5V, 8.5V (factory setting), adjustable by +/-1.5V in each case

Operating mode selector switch: Standby (antifreezing protection), manually controlled operation of the fan, operation of the fan in automatic mode

5 ... 30°C

Switching difference: 0.5K 0.5K at a temperature change of 4K/h

Proportional band, fan: adjustable within a range from 0.5 to 3K (factory setting 1.5K)

2K

1 ... 6K (factory setting 2K)

Neutral zone: when falling below a temp. of 18°C

ECO temperature difference: when transcending a temp. of 26°C

Heating / cooling changeover point: approx. 1K

In 2-pipe systems when using a flow sensor: approx. 5°C, temperature will not fall below this value thanks to the ECO function

Changeover point "cooling": approx. +1K

Changeover point "heating": < 1W / < 2VA

Tolerance of internal sensor: II (after conforming installation)

Antifreezing temperature: IP30 (after conforming installation)

Antifreezing switching difference: 0 ... 40°C

Power consumption: -20 ... 70°C

Protection class: max. 95% RH, non-condensing

Degree of protection: wall mounting or mounting on an UP box

Admissible ambient temperature: plastic (ABS) pure white, similar to RAL 9010

Storage temperature: operating mode selector switch "OFF / Manual / Automatic", 3-level fan switch, mechanical limitation of the setpoint setter, DIP switches for function selection, setting mark backlit with three different colours, laterally arranged push button for activation and termination of the parameter setting procedure

Admissible moisture: 2

Mounting: 4000V

Housing material and colour: I (contribution to seasonal space heating energy efficiency 1%)

Equipment: Degree of pollution: 2

Rated impulse voltage: 1

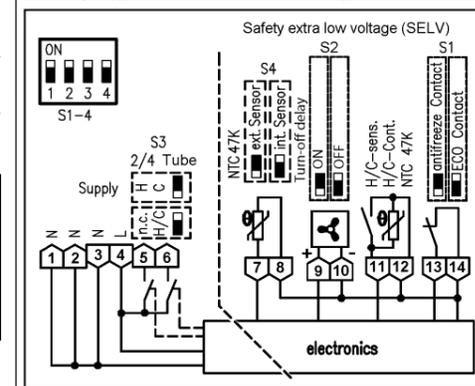
Energy efficiency class: I

6. Data table with external sensor data (characteristic curve)

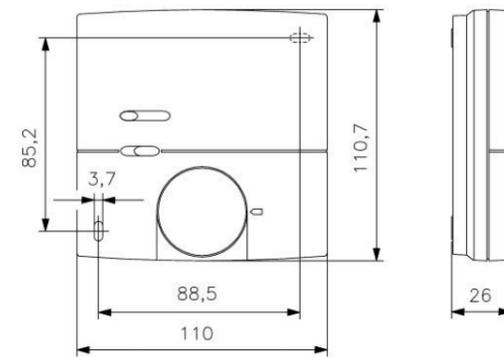
The table shown below applies to the optional change-over sensor and the external temperature sensor *2" – NTC 47k.

Sensor temperature [°C]	Resistance value [kOhm]
-10	264.028
0	155.480
10	94.377
15	74.314
20	58.910
25	47.000
30	37.732
40	24.750
50	16.597

7. Wiring diagrams and dimensioned drawings / overview of DIP switch positions (S1 to S4)



Caution: In the event the external contact input at the terminals 13 and 14 is not required, these terminals have to be connected with the aid of a jumper.



Switches S1 - S4

Schalter	ON	OFF	
S1	Contact via terminals 13 and 14 → ECO function	Contact via terminals 13 and 14 → ON/OFF function (antifreezing protection)	see section 2.8
S2	Fan turn-off delay OFF	Fan turn-off delay ON (10 minutes)	see section 2.5
S3	2-pipe system	4-pipe system	see section 2.1 see section 2.2
S4	Internal sensor	Terminals 7 and 8 → external sensor	see section 2.4

8. Warranty

The technical data specified in these instructions have been determined under laboratory conditions and in compliance with generally approved test regulations, in particular DIN standards. Technical characteristics can only be warranted to this extent. The testing with regard to the qualification and suitability for the client's intended application or the use under service conditions shall be the client's own duty. We refuse to grant any warranty with regard thereto. Subject to change without notice.