Product manual

ABB i-bus® EIB / KNX
Fan Coil Controller
FC/S 1.1

Intelligent Installation Systems

ABB

Contents

1 Introduction

Fan coil units are used for distributed heating and cooling. They are installed in the room and supplied via a
central heating and cooling system. The room temperature can be very quickly adapted to individual requirements using this system.

The Fan Coil Controller FC/S 1.1 has two outputs for controlling motor-driven or thermal heating and cooling valves. Multi-speed fans with up to three fan speeds can be switched via floating contacts. Two binary inputs are also available for monitoring windows and the formation of condensed water.

The Fan Coil Controller can either be integrated in the building installation system via the EIB or operated independently as an autonomous temperature controller. To do so, the temperature sensor TS/K 1.1 must be connected for recording the actual temperature. An adjustment of the setpoint temperature can be carried out if required using an additionally connected control potentiometer.

2 Device technology

2.1 Product and functional description FC/S 1.1

2CDC 071 036 F0004

The Fan Coil Controller controls motor-driven and thermal heating and cooling valves as well as multi-speed fans via the ABB i-bus EIB or as a stand-alone device in combination with the temperature sensor TS/K 1.1.

There are two binary inputs available for 24 V AC signalling contacts for window and drip tray monitoring. The 24 V AC auxiliary voltage for scanning the binary inputs is made available by the device. The Fan Coil Controller requires a 230 V AC power supply. All the connections are established via screw/plug-in terminals.

2.2 Technical data for FC/S 1.1

Power supply	– Operating voltage	230 V AC +/– 10 %, 50 … 60 Hz
	– Power consumption via EIB	max. 250 mW
	– Total power consumption	max. 9 W
Heating/cooling outputs	– 2 semi-conductor switches	For connecting motor-driven, raise/lower valve drives or thermal 24 V AC valve drives (max. 5 W)
	– Nominal voltage	24 V AC
	– Nominal current	250 mA
	– Continuous load	max. 5 W (resistive)
	– Cable length	max. 20 m
Fan outputs	– 3 floating contacts	for connecting fans with up to 3 speeds
	– Nominal voltage	230 V AC
	– Nominal current	6 A
Auxiliary voltage outputs	– For supplying the binary inputs	
	– Nominal voltage	24 V AC
	– Nominal current	5 mA
Signalling contact inputs	– 2 binary inputs	For window and drip tray monitoring
	– Nominal voltage	24 V AC
	– Cable length	max. 30 m
Temperature input	– Temperature sensor TS/K 1.1	For recording the ambient temperature
	– Potentiometer	4.7 kΩ, +/– 10 % linear as a setpoint temperature controller
		for a setpoint adjustment of +/– 3 °C
Operating and display elements	– Red LED	For entering the physical address and for testing the output functions
	– Programming button	For entering the physical address
	– Test button	For testing the heating, cooling and fan outputs

Connections	– 230 V AC power supply	2 screw terminals (green) Wire range: finely stranded: 1.0 – 1.5 mm^2 single-core: 1.0 mm^2
	– Heating output	3 screw terminals (red) Wire range: finely stranded: 0.75 – 1.5 mm^2 single-core: 0.75 – 1.0 mm^2
	– Cooling output	3 screw terminals (blue) Wire range: finely stranded: 0.75 – 1.5 mm^2 single-core: 0.75 – 1.0 mm^2
	– Fan outputs	5 screw terminals (green) Wire range: finely stranded: 1.0 – 1.5 mm^2 single-core: 1.0 mm^2
	– Binary inputs	2 screw terminals each (green) Wire range: finely stranded: 0.5 – 1.5 mm^2 single-core: 0.5 – 0.75 mm^2
	– Temperature sensor/ control potentiometer	4 screw terminals (green) Wire range: finely stranded: 0.5 – 1.5 mm^2 single-core: 0.5 – 0.75 mm^2
	– Auxiliary voltage output	2 screw terminals (green) Wire range: finely stranded: 0.5 – 1.5 mm^2 single-core: 0.5 – 0.75 mm^2
	– EIB / KNX	3 screw terminals (black) Wire range: single-core: 0.3 – 0.5 mm^2
Type of protection	– IP 20, EN 60 529	
Ambient temperature range	– Operation	– 5 °C ... + 45 °C
	– Storage	– 25 °C ... + 55 °C
	– Transport	– 25 °C ... + 70 °C
Design	– Modular installation device	
Housing, colour	– Plastic housing, grey/black	
Installation	– on 35 mm mounting rail, DIN EN 60 715	
Dimensions	– 86 x 105 x 58 mm (H x W x D)	
Mounting depth/width	– 58 mm/6 modules at 17.5 mm	
Weight	– 0.4 kg	
Certification	– EIB- and KNX-certified	
CE norm	– in accordance with the EMC guideline and the low voltage guideline	

Application programs	**max. number of communication objects**	**max. number of group addresses**	**max. number of associations**
Fan Coil Controller /1	35	80	80

2.3 Product and functional description TS/K 1.1

2CDC 071 037 F0004

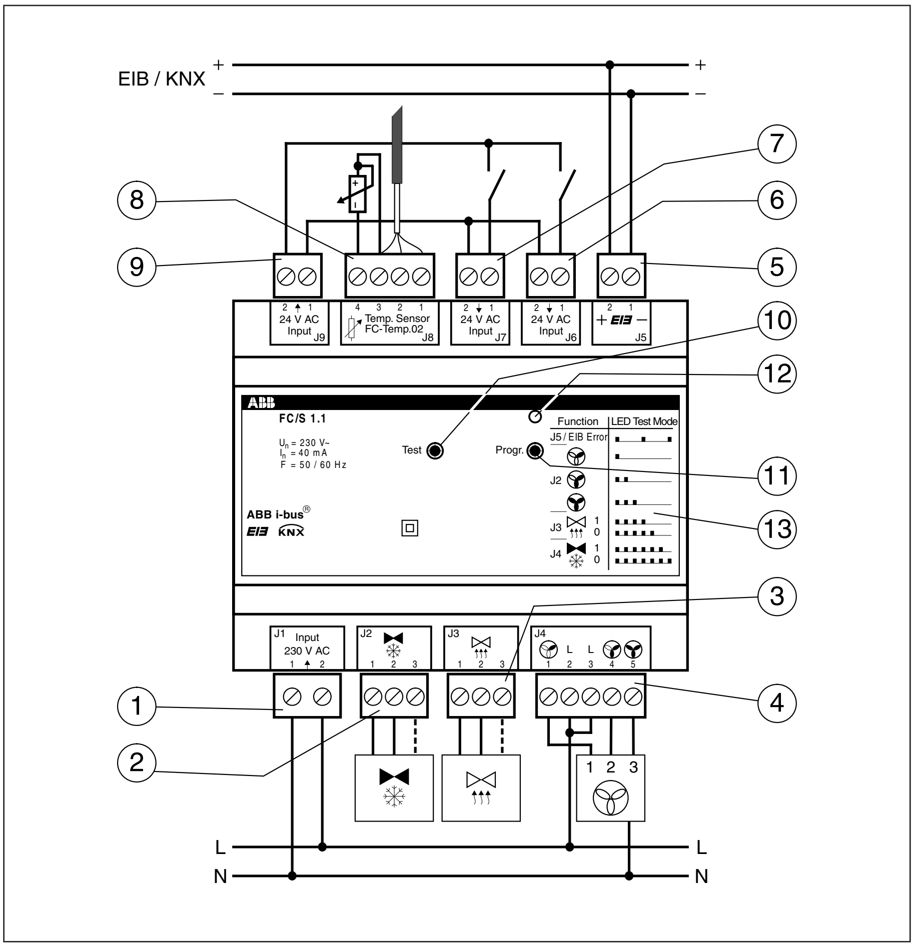
The temperature sensor measures the ambient temperature. It is connected to the Fan Coil Controller via screw terminals.

The temperature sensor can only be used in combination with the Fan Coil Controller FC/S 1.1!

2.4 Technical data for TS/K 1.1

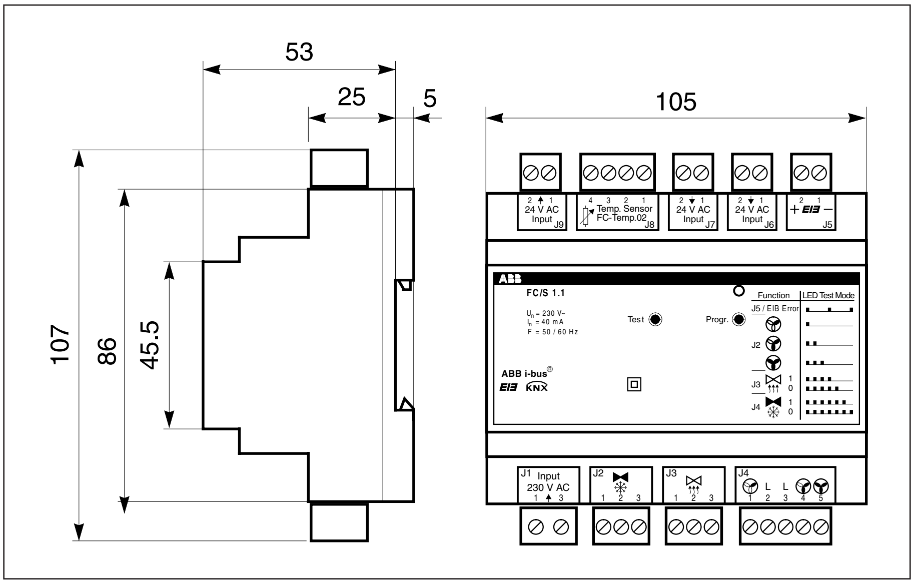
Cable	– Cables	3-core cable
	– Length	2 m
	– Colour	grey
Connections	– Type	Plug-in screw terminal strip
	– Module slot on FC/S 1.1	“Temp. sensor”
	– Green cable	Screw terminal 1
	– White cable	Screw terminal 2
	– Brown cable	Screw terminal 3
Ambient temperature range	– Operation	– 25 °C ... + 60 °C
	– Storage	– 25 °C ... + 60 °C
	– Transport	– 25 °C ... + 70 °C
Weight	– 0.05 kg	

2.5 Circuit diagram



1 Power supply 230 V AC
2 Cooling valve
3 Heating valve
4 Fan
5 EIB / KNX bus connection
6 Binary input 24 V AC for window contact
7 Binary input 24 V AC for drip tray monitoring
8 Temperature sensor input
9 Auxiliary voltage output for binary inputs
10 Test button
11 Programming button
12 Programming LED/Test LED
13 Test table

2.6 Dimension drawing



2.7 Notes

Commissioning
The Fan Coil Controller is supplied without a downloaded application program. The programming is carried out with ETS from version ETS2 V1.2 onwards.

After applying the mains voltage, it takes 1-2 minutes until the Fan Coil Controller is ready and the connected inputs and outputs can be controlled.

Voltage failure
In the event of a failure of the 230 V AC supply voltage, the valve outputs are de-energised and the contacts of the fan outputs are opened. On voltage recovery, the values of the communication objects and the status of the binary inputs, the temperature sensor and the potentiometer are evaluated and the outputs are controlled in accordance with the parameter settings.

If the EIB / KNX bus voltage fails, the Fan Coil Controller continues to function as a stand-alone device. The failure of the bus voltage is indicated by the flashing of the programming LED. If the expected telegram is omitted during cyclical monitoring of the actual temperature, the Fan Coil Controller switches to frost protection mode and sets the error status. On recovery of the EIB/ KNX bus voltage, the values of the communication objects as well as the status of the binary inputs, the temperature sensor and the potentiometer are evaluated and the outputs are controlled in accordance with the parameter settings.

Test function
When the 230 V AC power supply is applied, a test function of the device outputs can be activated to check the connected valves and fans.
The test can also be conducted without a downloaded application program and without an EIB / KNX connection.

The programming LED continually indicates the current status of the EIB/ KNX bus voltage. By pressing the test button for at least 4 seconds, the Fan Coil Controller switches to test mode (test level 1).
With each further activation of the test button, the 7 test levels are run through one after the other in a ring counting procedure and then the device is reset to normal operation. If the test button is not pressed for approx. 1 minute, the Fan Coil Controller switches automatically back to normal mode. The test LED indicates the status at each test level. The meaning of the display of the test LED is indicated in the test table on the device.

Normal operation (continuous display of the EIB / KNX bus voltage):
LED off: EIB/ KNX connection OK
LED flashes at short intervals: EIB / KNX connection is faulty or not available.

Test levels 1 to 3:
The fan connections are checked in test levels 1 to 3. The next fan speed up is selected with each push button action. The LED flashes once briefly (fan speed 1) or twice or three times (fan speeds 2 and 3).

Test levels 4 and 5:
The heating valve connection is checked in test levels 4 and 5. The heating valve is opened (flashes 4 times) or closed (flashes 5 times) with the next two push button actions.

Test levels 6 and 7:
The cooling valve connection is checked in test levels 6 and 7.
The cooling valve is opened (flashes 6 times) or closed (flashes 7 times) with the next two push button actions.

⚠ If there is a short circuit at one of the valve outputs, the test function is immediately interrupted within the corresponding test level.

3 Application and planning

3.1 Heating, ventilation and air-conditioning control with fan coil units

3.1.1 Terms

A fan coil unit is connected to a central heating and cooling supply and generates the required temperature room by room. A room can be heated, cooled and ventilated with a fan coil unit.

3.1.2 Structure of an HVAC system with fan coil units

An HVAC system with fan coil units (HVAC = Heating, ventilation, air-conditioning) consists of a central hot and cold water supply.
Fan coil units are mounted in the rooms and directly connected to the hot and cold water circulation loops (see Fig. 1).

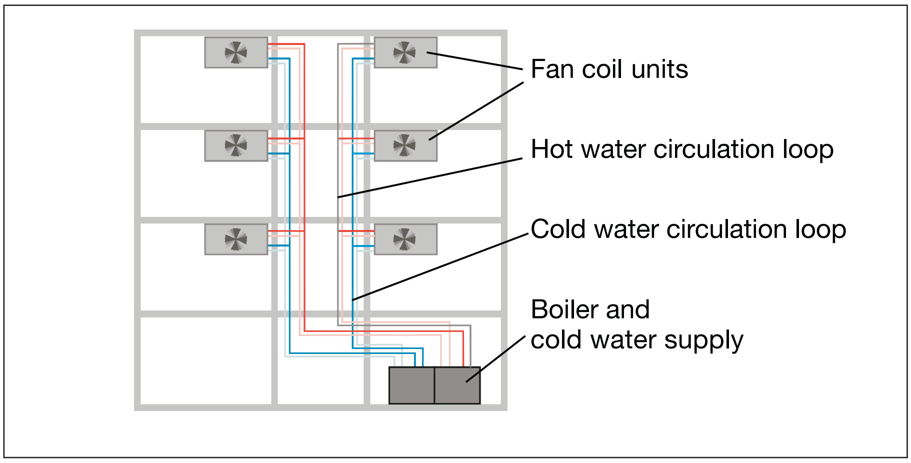


Fig. 1: Structure of an HVAC system with fan coil units

3.1.3 Structure of a fan coil unit

The heat exchangers and the fan are the most important components of a fan coil unit (see Fig. 2). The hot or cold water flows into the heat exchangers depending on the room temperature required.
The flow of water through the heat exchangers is controlled via the valves.

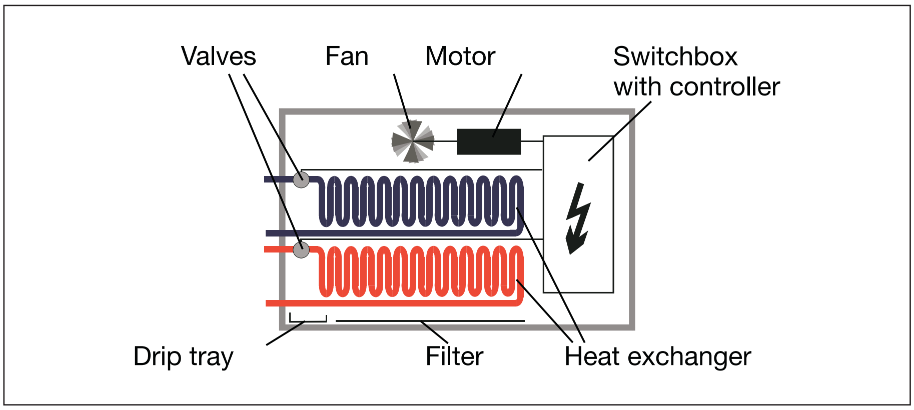


Fig. 2: Structure of a fan coil unit

The fan blows air past the heat exchangers and through a filter into the room. The air is heated or cooled at the heat exchangers and thus generates the required room temperature. The fan is driven by a motor. The motor and the valves are regulated by the Fan Coil Controller FC/S 1.1.

The condensed water that is generated by the cooling process is collected in a drip tray.

3.1.4 Variants

Pipe systems

A fan coil unit can be designed as a 4-pipe, 3-pipe or 2-pipe version. In the 4-pipe version, separate water circulation loops are used for hot and cold water. There are thus also two separate heat exchangers for heating and cooling which are each triggered via a valve (see Fig. 3).

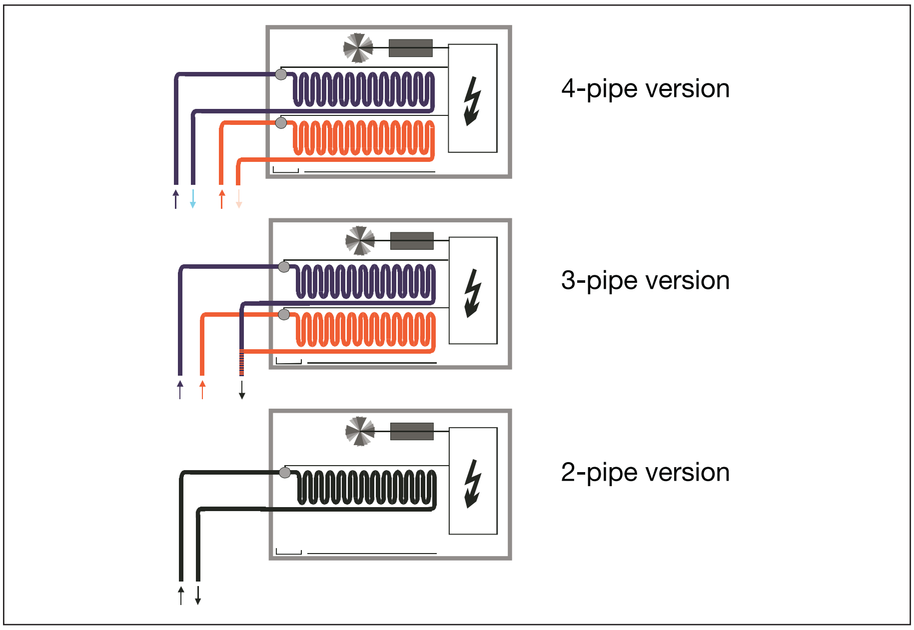


Fig. 3: Pipe systems

The 3-pipe version functions in a similar way to the 4-pipe version.
It also has a separate inlet for hot and cold water as well as two separate heat exchangers, each with a valve. In contrast to the 4-pipe version, the 3-pipe version has a common return flow for hot and cold water.

The 2-pipe version consists of a single water circulation loop, via which the room is either heated or cooled depending on the time of year. In a 2-pipe fan coil unit, there is only one heat exchanger and one valve.

In many HVAC systems, only cooling is carried out via a 2-pipe fan coil unit. The heating function is implemented by a conventional heater or by an electric heater in the fan coil unit.

Fig. 4 indicates the control of a 4-pipe system with the Fan Coil Controller FC/S 1.1.

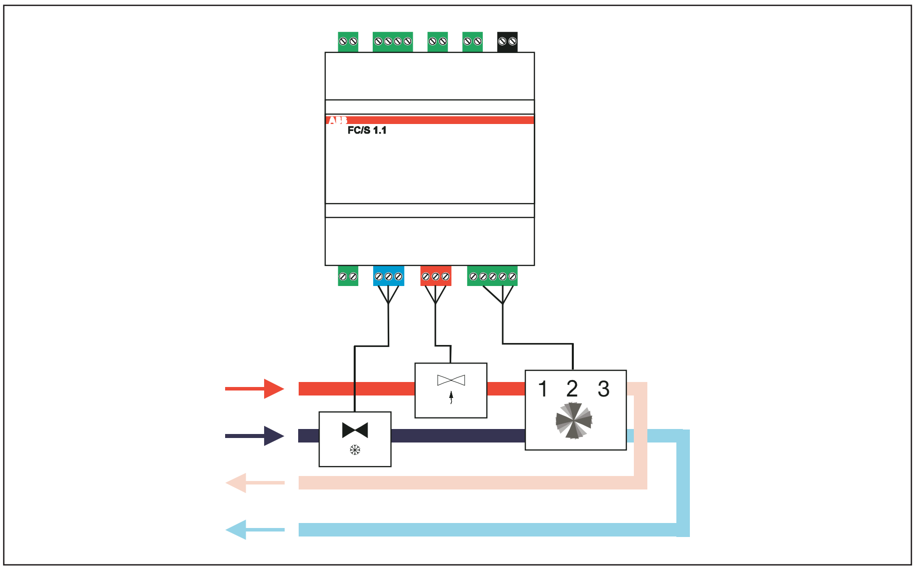


Fig. 4: Fan Coil Controller as "master"

Designs
A fan coil unit can be designed as a compact device or as a built-in device. Compact devices are supplied with housing and are available as upright units, units for wall mounting, or units for ceiling mounting.

Built-in devices are supplied without housing and are mounted in the wall, ceiling or in the floor. The air is blown through a screen into the room.

Air intake
Fan coil units are available as devices with circulating air or mixed air. In devices with circulating air, the ambient air is fed from the fan past the heat exchangers. In mixed air devices, the ambient air is mixed with fresh air. The ratio of circulating air to fresh air can be set in most cases.

Notes

3.2 Application examples

The Fan Coil Controller can be used very flexibly and can either be operated in “master” mode or as a “stand-alone” device.

3.2.1 Fan Coil Controller as „master“

System setup
In “master” mode, the Fan Coil Controller FC/S 1.1 is used to set the heating and cooling valves as well as to switch the fan outputs. The recording and regulation of the temperature is carried out at the same time by the Fan Coil Controller. To do so, the temperature controller TS/K 1.1 is connected to the Fan Coil Controller (see Fig. 6).

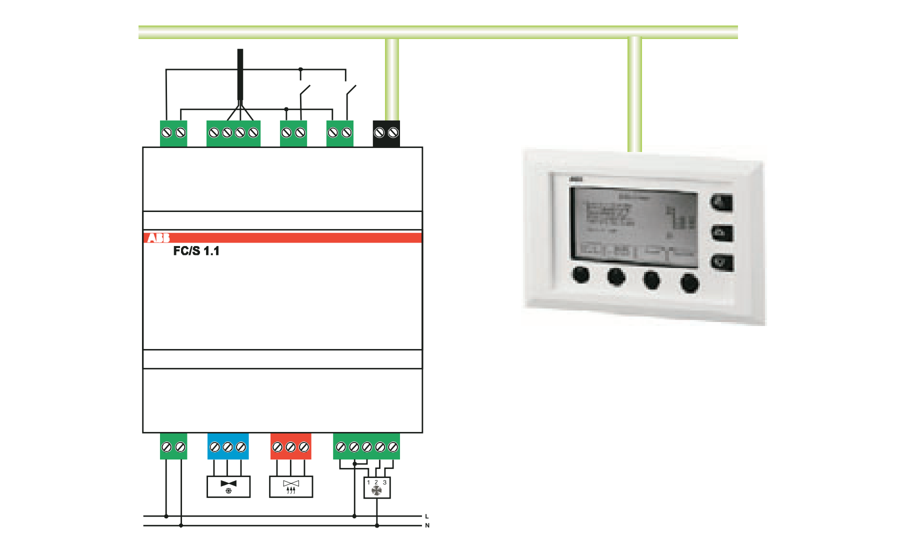


Fig. 6: Fan Coil Controller as “master”

The setpoint adjustment and the toggling of the operation are carried out via an EIB / KNX operator panel (e.g. MT701.2). To take the drip tray monitoring and the window contact into account, the sensors can be connected directly to the Fan Coil Controller.

Configuration as a master
To configure the Fan Coil Controller as a master, the following parameters must be set:

– Parameter: *Sensor for measuring the actual temperature*
(parameter window “Actual temperature”)
Option: “local”

– Parameter: *Setpoint adjustment*
(parameter window “Setpoints 1”)
Option: “via EIB”

3.2.2 Fan Coil Controller as „stand-alone“

System setup
In “stand-alone” mode, the Fan Coil Controller FC/S 1.1 takes over the recording of the actual temperature, complete control, the setting of the heating and cooling valves as well as the switching of the fan outputs. To do so, the temperature sensor TS/K 1.1 must be connected to the Fan Coil Controller (see Fig. 7).

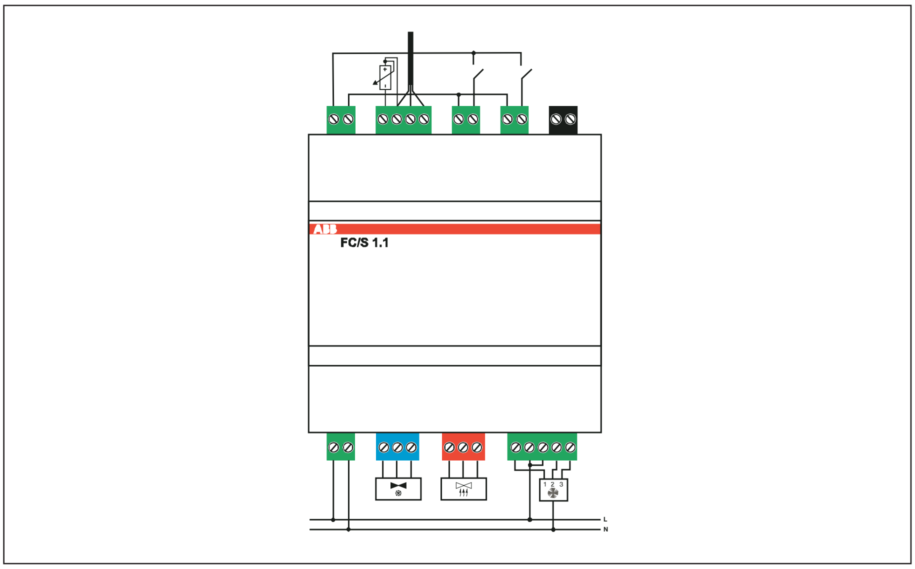


Fig. 7: Fan Coil Controller as “stand-alone”

The setpoint adjustment is carried out via a potentiometer which can be connected directly to the Fan Coil Controller. To take the drip tray monitoring and the window contact into account, the sensors can be connected directly to the Fan Coil Controller.

Configuration as a stand-alone device
To configure the Fan Coil Controller as a stand-alone device, the following parameters must be set:

– Parameter: *Sensor for measuring the actual temperature*
  (parameter window “Actual temperature”)
  Option: “local”

– Parameter: *Setpoint adjustment*
  (parameter window “Setpoints 1”)
  Option: “local”

3.3 Control of fans, lighting and electric heaters

3.3.1 Automatic fan control

Function

For automatic fan control, the fan drive is connected directly to the Fan Coil Controller and switched via three floating contacts.
It is possible to connect a 1-speed, 2-speed or 3-speed fan.

The fan speed is set automatically depending on the control value.
The corresponding fan speeds are parameterised for example for the following control value ranges:

Control value	Fan speed
0... 9 %	0 (fan off)
10...39 %	1
40...69 %	2
70...100 %	3

Configuration

To configure automatic fan control, the following parameters must be set:

– Parameter: *Type of fan*
(parameter window “Fan”)
Option: “local”

– Parameter: *Threshold value for switching on at fan speed X*
(parameter window “Fan”)
Option [%]: “0...100” (set value)

3.3.2 Direct fan control via the EIB / KNX

Function

For direct fan control, a fan drive is connected directly to the Fan Coil Controller and switched via three floating contacts. It is possible to connect a 1-speed, 2-speed or 3-speed fan.

The Fan Coil Controller sets the fan speed depending on a value that is received via the EIB / KNX. The value is received as a 1-byte value at the communication object “Fan – Manual operation of fan”. The conversion of the 1-byte value received into the fan speed is carried out as for automatic fan control via the parameterised threshold values.

1-byte value	Fan speed
0... 9 %	0 (fan off)
10...39 %	1
40...69 %	2
70...100 %	3

Configuration

To configure direct fan control, the following parameters must be set:

– Parameter: *Type of fan*
(parameter window “Fan”)
Option: “local”

– Parameter: *Threshold value for switching on at fan speed X*
(parameter window “Fan”)
Option [%]: “0...100” (set value)

3.3.3 Toggling between automatic and direct fan control

It is possible to toggle between automatic and manual fan control in the Fan Coil Controller. The switching to manual fan control is carried out via the 1-byte communication object “Fan – Manual operation of fan”. The fan speed is set according to the 1-byte value received.

Fan control is reset to automatic mode if a “1” is received at the 1-bit communication object “Fan – Toggling to automatic mode” or if the parameterised *Delay after manual override of fan* (parameter window “General”) has elapsed.

The current automatic control status is reported via the 1-bit communication object “Fan – Fan status (manual, automatic)” (“0” = manual fan control, “1” = automatic fan control).

3.3.4 Fan control via an EIB / KNX switch actuator

Function
A fan drive can also be controlled via the EIB / KNX with the Fan Coil Controller. The fan position is calculated by the FC/S 1.1 and then sent to an EIB / KNX switch actuator. The switch actuator automatically switches the fan speed according to the telegram value received.

Configuration “on/off”
A 1-speed fan can be controlled via the 1-bit communication object “Fan – Fan on/off”. The following parameters must be set during the configuration:

– Parameter: *Type of fan*
(parameter window “Fan”)
Option: “EIB on/off”

Configuration “3 speeds”
A 3-speed fan can be controlled via the three 1-bit communication objects “Fan – Speed X”. The following parameters must be set during the configuration:

– Parameter: *Type of fan*
(parameter window “Fan”)
Option: “EIB: 3 speeds”

– Parameter: *Threshold value for switching on at fan speed X*
(parameter window “Fan”)
Option [%]: “0...100” (set value)

Configuration “0...100 %”
A fan speed can be set with linear dependency on the control value via an analogue actuator in combination with an infinitely variable fan drive. To do so, the 1-byte communication object “Fan – Speed 0-100 %” is used. The following parameters must be set during the configuration:

– Parameter: *Type of fan*
(parameter window “Fan”)
Option: “EIB: 0...100 %”

– Parameter: *Threshold value for switching on at fan speed X*
(parameter window “Fan”)
Option [%]: “0...100” (set value)

3.3.5 Lighting control

Function
If no fan is connected or only a 1-speed or 2-speed fan is connected, the remaining floating outputs can be used for lighting control (see Fig. 8).

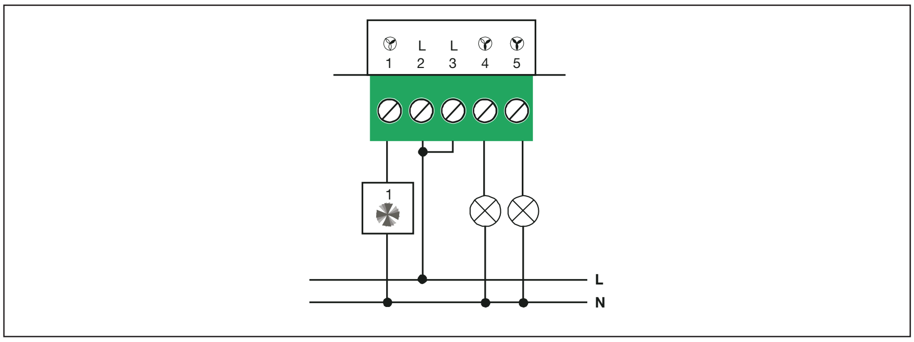


Fig. 8: Lighting control with the Fan Coil Controller

Each switching circuit must be fused separately with a circuit-breaker (max. 6 A, see also the instructions of the fan coil manufacturer).

Configuration
When configuring the lighting control in the example given, the following parameters must be set:

– Parameter: *Type of fan*
(parameter window "Fan")
Option: "local"

– Parameter: *Number of fan speeds*
(parameter window "Fan")
Option: "1"

The communication objects "Switch output – Switch output 2" and "Switch output – Switch output 3" are linked with the corresponding group address for lighting control. If one of these communication objects receives a "1", the corresponding output is switched on. If a "0" is received, the output is switched off.

3.3.6 Control of electric heaters

Function
If no fan is connected or only a 1-speed or 2-speed fan is connected, the remaining floating outputs can be used for controlling electric heaters (see Fig. 9).

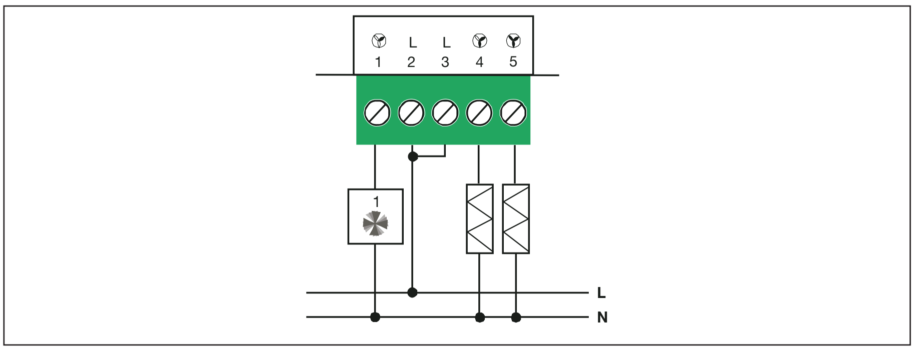


Fig. 9: Control of electric heaters

⚠ Each switching circuit must be fused separately with a circuit-breaker (max. 6 A, see also the instructions of the fan coil manufacturer).

Configuration
When configuring the control of electric heaters in the example given, the following parameters must be set:

– Parameter: *Type of fan*
(parameter window "Fan")
Option: "local"

– Parameter: *Number of fan speeds*
(parameter window "Fan")
Option: "1"

The communication objects "Switch output – Switch output 2" and "Switch output – Switch output 3" are linked with the corresponding group address for controlling the electric heating. If one of these communication objects receives a "1", the corresponding output is switched on. If a "0" is received, the output is switched off.

3.4 Operation modes and setpoint adjustment

3.4.1 Operation modes

The Fan Coil Controller can be operated in the following modes:

– comfort mode/comfort extension

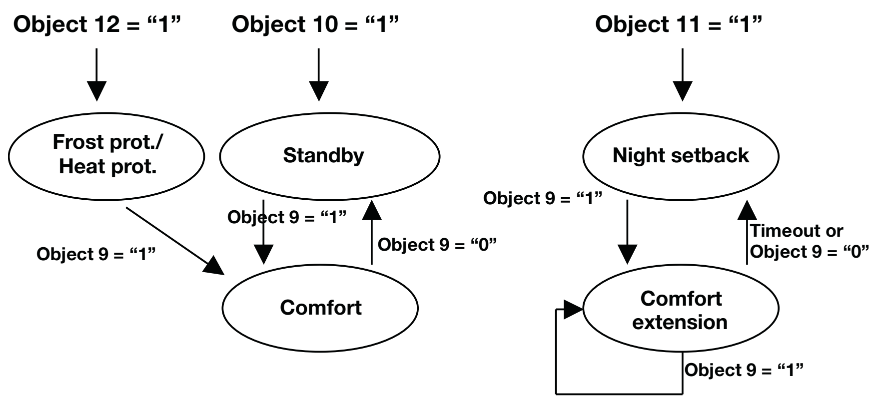
– standby mode

– night setback

– frost protection/heat protection

– frost alarm

The toggling between the operation modes is carried out via communication objects. The correlation is represented in Fig. 10.



Object 9: Mode selection – ON command for comfort, comfort extension
Object 10: Mode selection – ON command for standby mode
Object 11: Mode selection – ON command for night setback
Object 12: Mode selection – ON command for frost protection
Timeout: Parameterised *Extended comfort mode* has elapsed

Fig. 10: Mode selection via communication objects

The required operation mode is selected directly with a “1” at the communication objects 10, 11 and 12 (frost protection, standby, night setback).

The Fan Coil Controller is switched to comfort mode with a “1” at communication object 9, if the device was previously in frost protection or standby mode. If night setback is active however, the comfort extension mode is selected with a “1” at communication object 9.

The difference between comfort mode and comfort extension is that the toggling from comfort mode to another mode is triggered via a communication object while switching from comfort extension mode to another mode also takes place automatically once the parameterised *Extended comfort mode* has elapsed.

With this function, it is possible to extend the comfort temperature in the room with a push button action e.g. if you have guests in the evening and the room therefore needs to be heated or cooled for longer than usual.

The frost alarm mode is activated if the room temperature falls below the parameterised threshold value. In frost alarm mode, the valve is positioned according to a fixed control value. Temperature regulation does not take place.

3.4.2 Setpoint values

Different setpoint values can be set in the Fan Coil Controller. The setting is carried out in the parameter window “Setpoints 1” and “Setpoints 2” via the parameters:

– Base setpoint temperature
– Setpoint adjustment
– Insensitive zone between heating and cooling
– Increase or reduction in standby mode
– Threshold value for frost or heat protection mode
– Setpoint limit for heating or cooling

With the exception of setpoint adjustment, all the setpoints are set as parameters via the ETS program (parameter window “Setpoints 1” and “Setpoints 2”). The setpoint adjustment is set via the EIB / KNX using a local potentiometer and thus offers the user the possibility of carrying out individual adaptations when the device is in operation. The base setpoint temperature can both be set as a parameter and received via the EIB / KNX.

The current respective setpoint temperature which is set via the valves and the fan is calculated from these settings:

In comfort mode:
Heating: Setpoint temperature = Base setpoint temperature + Setpoint adjustment
Cooling: Setpoint temperature = Base setpoint temperature + Setpoint adjustment + Insensitive zone + Dependency on the external temperature if necessary (see Chapter 3.4.3)

In standby mode:
Heating: Setpoint temperature = Base setpoint temperature – Reduced heating in standby mode + Setpoint adjustment
Cooling: Setpoint temperature = Base setpoint temperature + Increased cooling in standby mode + Setpoint adjustment

In night setback mode:
Heating: Setpoint temperature = Base setpoint temperature – Reduced heating during night setback + Setpoint adjustment
Cooling: Setpoint temperature = Base setpoint temperature + Increased cooling during night setback + Setpoint adjustment

In frost/heat protection mode:
Heating: Setpoint temperature = Threshold value for frost protection
Cooling: Setpoint temperature = Threshold value for heat protection

The setpoint temperature is restricted by the setpoint limit value.
The setpoint limit for heating defines the maximum temperature for heating the room. The setpoint limit for cooling defines the minimum temperature for cooling the room.

3.4.3 Setpoint correction dependent on external temperature

A correction of the temperature setpoint dependent on the external temperature is provided for comfort mode. This function automatically adapts the setpoint temperature to the external temperature when cooling the room and thus represents an additional restriction of the setpoint temperature.

The correction of the setpoint is set from the parameterised threshold value of the external temperature (parameter: *Minimum external temperature for correcting the setpoint*, parameter window "Setpoints 1").

The setpoint value is adapted in proportion to the change in the external temperature when this threshold value is exceeded: the setpoint value increases by 1 °C with each 3 °C rise in the external temperature (see Fig. 11).

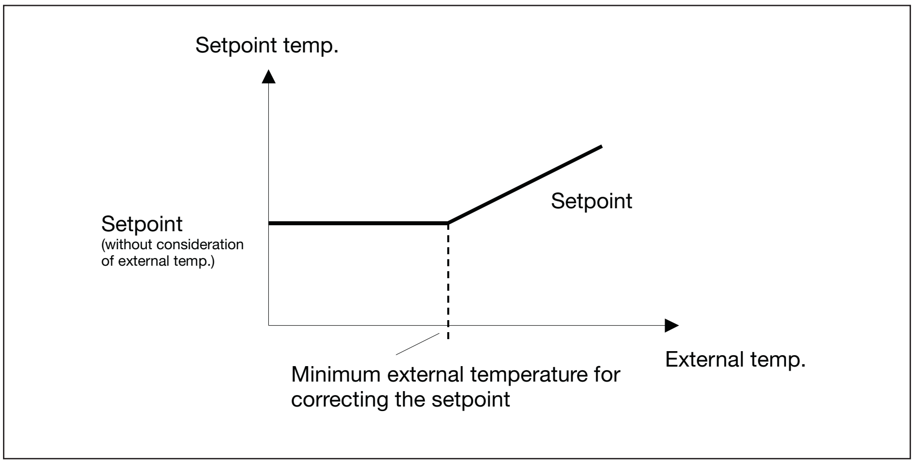


Fig. 11: Setpoint correction dependent on external temperature

3.5 Valve drives, valves and controllers

3.5.1 Valve drives

The Fan Coil Controller can control the following valve drives:

– Electromotive valve drives

– Electrothermal valve drives

– EIB valve drives

Electromotive valve drives
Electromotive valve drives close and open valves via a small electric motor. Electromotive valve drives are available as proportional, two-step or raise/lower valve drives.

Proportional valve drives are controlled via an analogue signal (e.g. 0...10 V). Continuous-action control is used as the control type (see Chapter 3.5.3). Two-step or raise/lower valve drives are controlled via the switching of the supply voltage. Proportional valve drives <u>cannot</u> be regulated with the Fan Coil Controller.

Two-step valve drives are controlled via the commands “open” and “closed”. The valve can only be fully opened or fully closed. Two-step valves are controlled via two-step control or pulse width modulation (see Chapter 3.5.3). Two-step valve drives can likewise <u>not</u> be controlled with the Fan Coil Controller.

The Fan Coil Controller supports the control of electromotive raise/lower valve drives. These valve drives are connected to the Fan Coil Controller via three connecting cables: neutral conductor, switched phase for open, switched phase for closed (see Fig. 12). With raise/lower valve drives, the valve can be opened to any percentage value and this position is retained for a longer period. If the valve is not moved, no voltage is applied at the motor.

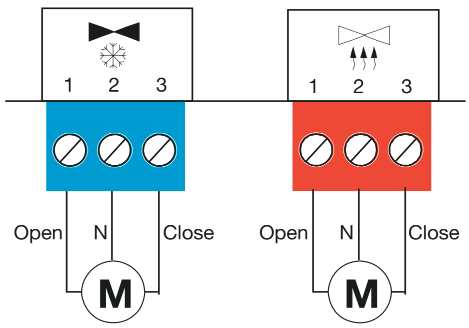


Fig. 12: Connection of electromotive raise/lower valve drives

The valve is opened so that precisely the right amount of hot or cold water can flow through in order to bring the heat exchanger to the required temperature. The valve is thus regulated via the valve opening (0...100 %). Continuous-action control can be applied in most cases (see Chapter 3.5.3).

Alternatively, an electromotive valve drive can also be regulated via two-step control or pulse width modulation. The valve is fully opened for several minutes and then closed again (see Chapter 3.5.3).

Electrothermal valve drives

Electrothermal valve drives are adjusted via the heat expansion of a material as a result of a flow of electrical current. Electrothermal valve drives are regulated via two-step control or pulse width modulation (see Chapter 3.5.3). The Fan Coil Controller supports the control of electrothermal valve drives via pulse width modulation.

Electrothermal valve drives are available in the design variants “de-energised closed” and “de-energised open”. Depending on the design variant, the valve is opened if voltage is present and closed if voltage is not applied or vice versa.

Electrothermal valve drives are connected to the Fan Coil Controller via two connecting cables: switched phase and neutral conductor for AC valve drives or “+” and “-“ for DC valve drives (see Fig. 13).

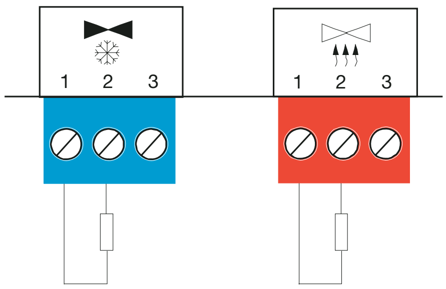


Fig. 13: Connection of electrothermal valve drives

EIB valve drives

If EIB valve drives are used (e.g. ST/K 1.1), the outputs of the Fan Coil Controller remain free. The Fan Coil Controller sends the calculated control value via the EIB. The EIB valve drive receives the control value and regulates the valve accordingly (see Fig. 14).

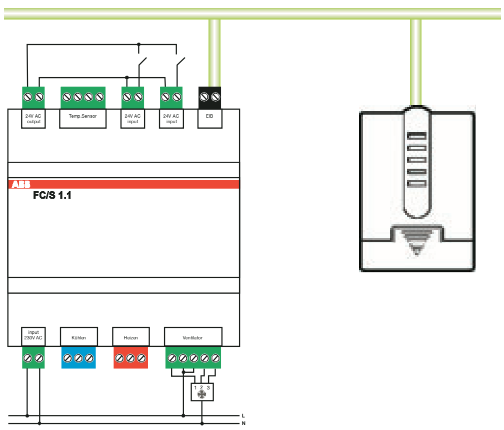


Fig. 14: Connection of EIB valve drives

If required, a valve drive can be connected to the Fan Coil Controller for the cooling valve and an EIB valve drive can be used at the same time to control a heating valve or vice versa.

3.5.2 Valve characteristics

The Fan Coil Controller regulates valves with a linear valve characteristic. The valve position is linearly adjusted to the control value. At a control value of 0 %, the valve is closed (i.e. likewise 0 %). At a control value of 100 %, the valve is fully opened (i.e. likewise 100 %). The same ratio applies for all intermediate values (see Fig. 15).

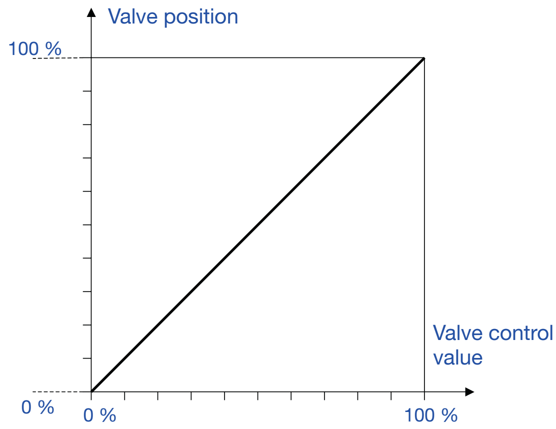


Fig. 15: Linear valve characteristic

This valve characteristic can be adapted for different valve types.
Many valves have for example almost no flow when they are slightly opened and already reach their maximum flow rate at 60 – 80 %. There is also the fact that a disruptive whistling noise is generated in many valves with a low flow rate.

These effects can be taken into account by limiting the active valve opening range (see Fig. 16). The positioning frequency of the valve drive can also be reduced by this restriction.

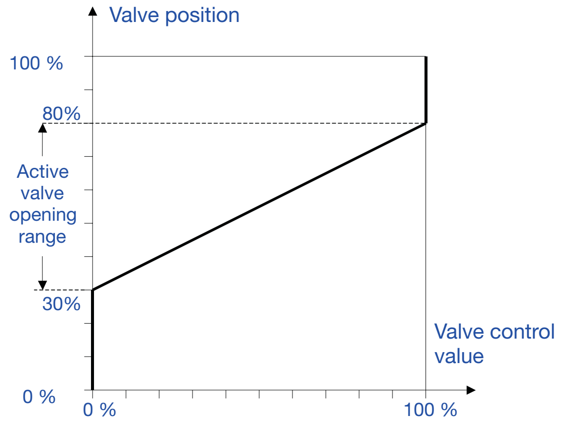


Fig. 16: Limitation of the active valve opening range

A further adaptation of the valve characteristic is carried out via the restriction of the valve control value. Due to this limit, the valve output does not react to the control value in the lower and upper limit ranges. A valve movement can thus be avoided for example when there is a negligible demand for heating or cooling (see Fig. 17).

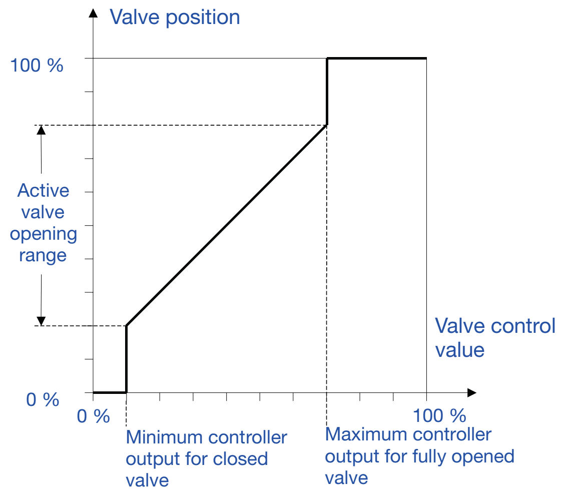


Fig. 17: Limitation of the valve control value

A further adjustment of the characteristic can be carried out via the parameter *Response threshold of valve* (parameter window “Heating valve” or “Cooling valve”). It is set via this parameter which change in the valve control value determines that the valve position should be adapted to the control value. The positioning frequency of the valve drive is likewise reduced by this function.

⚠ A reduction in the positioning frequency decreases the power required for the positioning and increases the service life of the valve. However, a low positioning frequency also diminishes the accuracy of the temperature control.

3.5.3 Types of control

Two-step control, continuous-action control and pulse width modulation are generally used to control valves in heating, ventilation and air-conditioning technology.

Two-step control
With two-step control, the valve is fully opened if the room temperature falls below a lower limit value while the valve is fully closed if the room temperature exceeds an upper limit value (see Fig. 18).

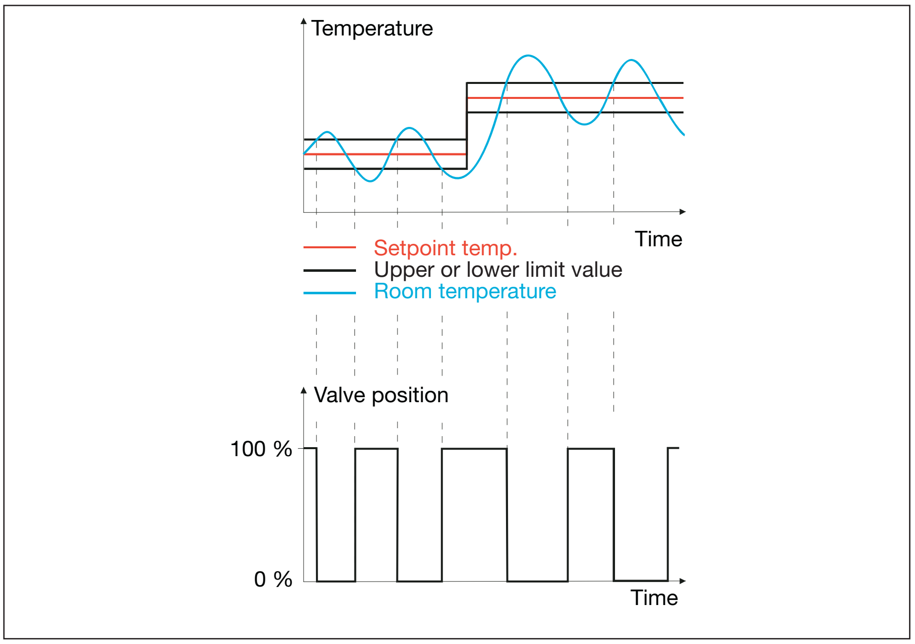


Fig. 18: Two-step control

The benefits of two-step control are the easy control method and the use of simple, cost-effective valve drives. The disadvantages include the high positioning frequency and the continuously fluctuating room temperature. In heating and cooling systems with a time delay, this can lead in particular to a considerable overshoot of the limit values.

Two-step control is not supported by the Fan Coil Controller.

Continuous-action control
With continuous-action control, a control value is calculated from the actual temperature and the setpoint temperature and then used for the optimum regulation of the temperature. The valve is moved to a position which corresponds to the calculated control value. The valve can thereby be fully opened, fully closed and moved to any intermediate position (see Fig. 19).

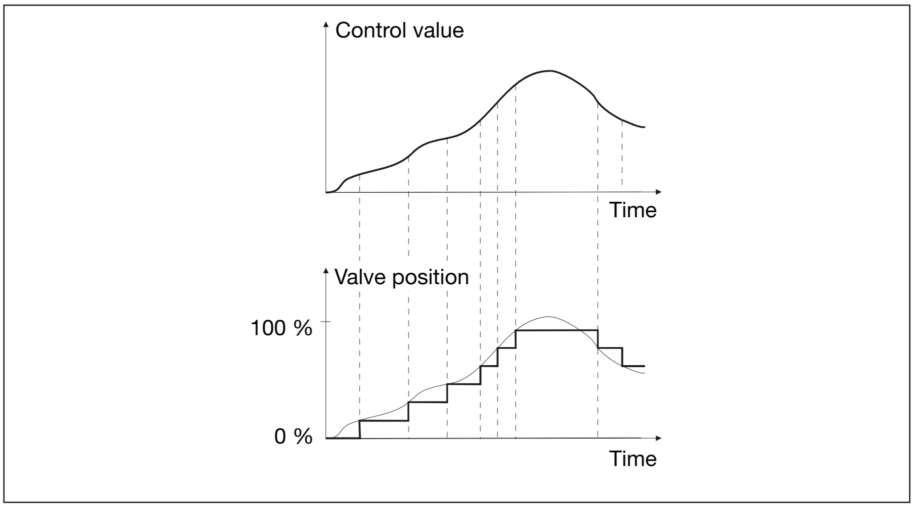


Fig. 19: Continuous-action control

With continuous-action control, the most accurate regulation of the temperature can be achieved without considerable overshoots. At the same time, the positioning frequency of the valve drive can be kept at a low level.

The continuous-action control can be used with the Fan Coil Controller for electromotive raise/lower valves or EIB valve drives.

Pulse width modulation
With pulse width modulation, the valve is only operated in the positions "fully opened" and "fully closed" as in two-step control. In contrast to two-step control, the position is not regulated via limit values but from the calculated control value, in a similar way to continuous-action control.

The control value is fixed for a cyclic period and converted into the valve opening duration. For example, the control value 20 % is converted at a cyclic period of 15 minutes into a valve opening time of 3 minutes.
The control value 50 % produces a valve opening time of 7.5 minutes (see Fig. 20).

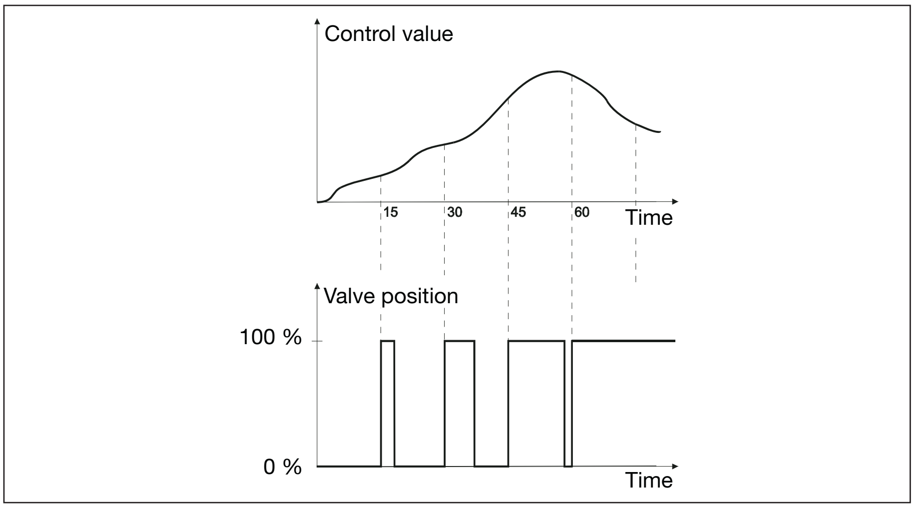


Fig. 20: Pulse width modulation

With pulse width modulation, a relatively accurate regulation of the temperature can be achieved without considerable overshoots.
Simple, cost-effective valve drives can be used. The positioning frequency of the valve drive is relatively high.

Pulse width modulation can be used with the Fan Coil Controller for electromotive, electrothermal or EIB valve drives.

4 Project design and programming

4.1 Description of the communication objects

no.	Function	Object name	C	R	W	T	U	Type
0	Actual temperature	Input/output for actual temperature	✓	✓	✓	✓	✓	2 Byte
1	Actual temperature	Actual temperature error signal	✓	✓		✓		1 Bit
2	External temperature	External temperature	✓		✓		✓	2 Byte
3	External temperature	External temperature error signal	✓	✓		✓		1 Bit
4	Setpoint	Base setpoint temperature	✓	✓	✓		✓	2 Byte
5	Setpoint	Setpoint adjustment	✓	✓	✓		✓	2 Byte
6	Setpoint	Instantaneous setpoint	✓	✓		✓		2 Byte
7	2-pipe operation	Activation of heating mode	✓	✓	✓		✓	1 Bit
8	2-pipe operation	Activation of cooling mode	✓	✓	✓		✓	1 Bit
9	Mode selection	ON command for comfort, comfort extension	✓		✓		✓	1 Bit
10	Mode selection	ON command for standby mode	✓		✓		✓	1 Bit
11	Mode selection	ON command for night setback	✓		✓		✓	1 Bit
12	Mode selection	ON command for frost protection	✓		✓		✓	1 Bit
13	Window contact	Input for window contact	✓		✓		✓	1 Bit
14	Mode selection	Presence detector	✓		✓		✓	1 Bit
15	Fan	Manual operation of fan	✓		✓		✓	1 Byte
16	Fan	Toggling to automatic mode	✓		✓		✓	1 Bit
17	Fan	Fan status (manual, automatic)	✓	✓		✓		1 Bit
18	Fan	Speed 1	✓			✓		1 Bit
19	Fan	Speed 2	✓			✓		1 Bit
20	Fan	Speed 3	✓			✓		1 Bit
21	Heating valve	Output for heating valve	✓			✓		1 Byte
22	Cooling valve	Output for cooling valve	✓			✓		1 Byte
23	Controller	Control value for PI controller	✓		✓	✓	✓	2 Byte
24	Dew point detector	Dew point signal	✓		✓		✓	1 Bit
25	Temperature monitoring	Frost alarm error signal	✓	✓		✓		1 Bit
26	Temperature monitoring	Temperature error signal (limit violation)	✓	✓		✓		1 Bit
27	Drip tray overflow	Drip tray overflow signal	✓	✓		✓		1 Bit
28	Error information	Group alarm signal	✓	✓		✓		1 Bit
29	Error signal	Error information	✓	✓				1 Byte
30	Status	Status of fan coil controller	✓	✓				2 Byte
31	Status	Status of comfort mode	✓	✓		✓		1 Bit
32	Manual override	# dummy	✓	✓		✓	✓	1 Bit
33	Switch output	Switch output 1	✓		✓		✓	1 Bit
34	Switch output	Switch output 2	✓		✓		✓	1 Bit
35	Switch output	Switch output 3	✓		✓		✓	1 Bit

Fig. 21: Communication objects

0 Actual temperature – Input/output for actual temperature (EIS 5: 2 Byte)

If the Fan Coil Controller is operated with the temperature sensor TS/K 1.1 connected, the actual temperature is sent to this communication object via the EIB / KNX. The parameterised *Correction value* is included.

If the Fan Coil Controller is operated without the temperature sensor, it receives the actual temperature via the EIB / KNX at this communication object.

Telegram value: Coded value (see EIB / KNX manual)

1 Actual temperature – Actual temperature error signal (EIS 1: 1 Bit)

If no telegrams are received at the communication object "Actual temperature – Input/output for actual temperature" within the parameterised *Monitoring period* of actual temperature, the Fan Coil Controller sends an error signal via this communication object.

Telegram value:	"0":	No error
	"1":	Error

2 External temperature – External temperature (EIS 5: 2 Byte)

The Fan Coil Controller receives the external temperature at this communication object.

Telegram value: Coded value (see EIB / KNX manual)

3 External temperature – External temperature error signal (EIS 1: 1 Bit)

If no telegrams are received at the communication object "External temperature – External temperature" within the parameterised *Monitoring period for external temperature*, the Fan Coil Controller sends an error signal via this communication object.

Telegram value:	"0":	No error
	"1":	Error

4 Setpoint – Base setpoint temperature (EIS 5: 2 Byte)

The Fan Coil Controller receives the base setpoint temperature at this communication object.

Telegram value: Coded value (see EIB / KNX manual)

5 Setpoint – Setpoint adjustment (EIS 5: 2 Byte)

The Fan Coil Controller receives the setpoint adjustment at this communication object.

Telegram value: Coded value (see EIB / KNX manual)

6 Setpoint – Instantaneous setpoint (EIS 5: 2 Byte)

The current setpoint (base setpoint including the setpoint adjustment and reduction/increase in standby mode or during night setback) can be read out from this communication object.

Telegram value: Coded value (see EIB / KNX manual)

7 2-pipe operation – Activation of heating mode (EIS 1: 1 Bit)
8 2-pipe operation – Activation of cooling mode (EIS 1: 1 Bit)

These communication objects are only visible if the option "1 common valve (heating and cooling)" is set in the parameter Valves.

Heating or cooling mode is activated via these communication objects. If a "1" is received at both communication objects, the final value received is definitive.

Telegram value:	"0":	deactivated
	"1":	activated

9 Mode selection – ON command for comfort, comfort extension (EIS 1: 1 Bit)

The Fan Coil Controller is switched to comfort mode via this communication object.

If the device has been switched from comfort mode to night setback mode, the comfort extension is activated for the duration of the parameterised *Extended comfort mode* by a telegram at this communication object. The comfort extension is restarted by each subsequent telegram.

Telegram value:	"0":	No function
	"1":	Comfort mode/comfort extension

10 Mode selection – ON command for standby mode (EIS 1: 1 Bit)

The Fan Coil Controller is switched to standby mode via this communication object.

Telegram value:	"0":	No function
	"1":	Standby mode

11 Mode selection – ON command for night setback (EIS 1: 1 Bit)

The Fan Coil Controller is switched to night setback mode via this communication object.

Telegram value:	"0":	No function
	"1":	Night setback

12 Mode selection – ON command for frost protection (EIS 1: 1 Bit)

The Fan Coil Controller is switched to frost protection or heat protection via this communication object.

Telegram value:	"0":	No function
	"1":	Frost protection/heat protection

13 Window contact – Input for window contact (EIS 1: 1 Bit)

This communication object is only visible if the option "normal" or "inverted" has been selected for the parameter *Type of EIB window contact*.

The status of an EIB window contact is received via this communication object.

Telegram value:	"0":	Window closed
	"1":	Window open

14 Mode selection – Presence detector (EIS 1: 1 Bit)

The Fan Coil Controller is switched to comfort mode via this communication object. This communication object can be used for control via a presence detector.

Telegram value:	"0":	No function
	"1":	Comfort mode/comfort extension

15 Fan – Manual operation of fan (EIS 6: 1 Byte)
The fan is controlled via this communication object by specifying a percentage value via the EIB / KNX. The automatic mode of the fan is thereby deactivated. The percentage value is converted into the appropriate fan speed by the parameterised *Threshold value for switching on at fan speed X*.

The fan maintains the set speed until a "1" is received at the communication object "Fan – Toggling to automatic mode" or until the parameterised *Delay after manual override of fan* has elapsed.

Telegram value:	"0":	Fan off (0 %)
	"..."	
	"255":	Max. fan speed active (100 %)

16 Fan – Toggling to automatic mode (EIS 1: 1 Bit)
The fan is reset to automatic mode via this communication object if automatic mode has been deactivated by a telegram at the communication object "Fan – Manual operation of fan". The fan speeds are automatically controlled by the Fan Coil Controller in automatic mode.

Telegram value:	"0":	No function
	"1":	Automatic mode activated

17 Fan – Fan status (manual, automatic) (EIS 1: 1 Bit)
Using this communication object, the status of the fan operation mode is reported back via the EIB / KNX.

Telegram value:	"0":	Manual
	"1":	Automatic mode activated

18 Fan – Speed 1 (EIS 1: 1 Bit)
19 Fan – Speed 2 (EIS 1: 1 Bit)
20 Fan – Speed 3 (EIS 1: 1 Bit)
These communication objects are only visible if the option "EIB: 3 speeds" is selected for the parameter *Type of fan*.

An EIB / KNX switch actuator for setting the active fan speed is controlled via these communication objects.

Telegram value:	"0":	Deactivated
	"1":	Activated

18 Fan – on/off (EIS 1: 1 Bit)
This communication object is only visible if the option "EIB: on/off" is selected for the parameter *Type of fan*.

An EIB / KNX switch actuator for switching the fan on/off is controlled via these communication objects.

Telegram value:	"0":	Deactivated
	"1":	Activated

19 Fan – Speed 0...100 % (EIS 6: 1 Byte)
This communication object is only visible if the option "EIB: 0…100 %" has been selected for the parameter *Type of fan*.

Using this communication object, the active fan speed is sent as a percentage value via the EIB / KNX. With this value, an EIB / KNX analogue output can be used for example to set an infinitely adjustable fan drive.

Telegram value:	"0":	Fan off (0 %)
	"85":	Fan at speed 1 (33 %)
	"170":	Fan at speed 2 (67 %)
	"255":	Fan at speed 3 (100 %)

21 Heating valve – Output for heating valve (EIS 6: 1 Byte)
22 Cooling valve – Output for cooling valve (EIS 6: 1 Byte)
These communication objects are only visible if the option "EIB valve, continuous" is selected for the parameter *Type of heating valve* or *Type of cooling valve*.

Using this communication object, an EIB valve (e.g. on the heater) is controlled by continuous-action control.

Telegram value:	"0":	Valve fully closed (0 %)
	"...":	Intermediate position
	"255":	Valve fully open (100 %)

21 Heating valve – Output for heating valve (EIS 1: 1 Bit)
22 Cooling valve – Output for cooling valve (EIS 1: 1 Bit)
These communication objects are only visible if the option "EIB valve, pulse width modulation" is selected for the parameter *Type of heating valve* or *Type of cooling valve*.

Using this communication object, an EIB valve (e.g. on the heater) is controlled by pulse width modulation.

Telegram value:	"0":	Valve closed
	"1":	Valve open

23 Controller – Control value for PI controller (EIS 5: 2 Byte)
These communication objects are only visible if the option "on" is selected for the parameter *Sending of control value*.

Using this communication object, the control value of the PI controller is sent via the EIB / KNX. This information can be used for visualisation and for fault location.

Telegram value:	"- 670760":	Cooling 100 %
	"...":	Intermediate value
	"0":	Cooling 0 % and heating 0 %
	"...":	Intermediate value
	"670760":	Heating 100 %

24 Dew point detector – Dew point signal (EIS 1: 1 Bit)
The Fan Coil Controller receives a dew point alarm via this communication object and deactivates the cooling mode. The cooling mode is reactivated on receipt of a telegram with the value "0" and after the parameterised *Disabled time for cooling after end of dew point alarm.*

Telegram value:	"0":	No dew point alarm
	"1":	Dew point alarm

25 Temperature monitoring – Frost alarm error signal (EIS 1: 1 Bit)
The Fan Coil Controller sends information via this communication object about whether frost protection mode is active.

Telegram value:	"0":	No frost protection
	"1":	Frost protection

26 Temperature monitoring – Temperature error signal (limit violation) (EIS 1: 1 Bit)
The Fan Coil Controller sends an error signal via this communication object if the differential between the setpoint and actual temperature is greater than the parameterised *Maximum value* for the duration of the parameterised *Alarm delay*.

Telegram value:	"0":	No error
	"1":	Temperature error

27 Drip tray overflow – Drip tray overflow signal (EIS 1: 1 Bit)
The Fan Coil Controller sends a drip tray overflow signal via this communication object.

This communication object is only visible if the option "Drip tray monitoring normal" or "Drip tray monitoring inverted" is selected for the parameter *Input 1 / Drip tray monitoring*.

Cooling is automatically deactivated in the event of a drip tray overflow.

Telegram value:	"0":	No drip tray alarm (normal)
	"1":	Drip tray alarm (normal)
	"0":	Drip tray alarm (inverted)
	"1":	No drip tray alarm (inverted)

27 Input 1 – Input 1 (EIS 1: 1 Bit)
The Fan Coil Controller sends the status of a binary input at the drip tray overflow contact via this communication object.

This communication object is only visible if the option "Input normal" or "Input inverted" is selected for the parameter *Input 1 / Drip tray monitoring*.

Telegram value:	"0":	Contact open (input normal)
	"1":	Contact closed (input normal)
	"0":	Contact closed (input inverted)
	"1":	Contact open (input inverted)

28 Error information – Group alarm signal (EIS 1: 1 Bit)
The Fan Coil Controller sends an error signal via this communication object if one of the following errors occurs:

– Actual temperature error

– External temperature error

– Frost alarm

– Temperature monitoring.

The error signals are logically connected with an OR operation.

Telegram value:	"0":	No error
	"1":	Error

29 Error signal – Error information (1 Byte, non EIS)
The error status of the Fan Coil Controller is sent via the EIB / KNX using this communication object.

Telegram code:	76543210	
Telegram value:	"0":	No error
	"1":	Error
Bit no.:	0:	Actual temperature error
	1:	External temperature error
	2:	Frost alarm
	3:	Temperature monitoring
	4-7:	Free (contains no information)

A status byte table with all the possible combinations is printed in the appendix (see Chapter 5.1).

30 Status – Status of fan coil controller (2 Byte, non EIS)
The operating state of the Fan Coil Controller is sent via the EIB / KNX using this communication object.

Cooling is automatically deactivated in the event of a drip tray overflow.

Telegram code:	1st byte: 76543210	
Telegram value:	"0":	Deactivated
	"1":	Activated
Bit no.:	0:	Heating
	1:	Cooling
	2:	Window open
	3:	Drip tray overflow
	4-7:	Free (contains no information)
	2nd byte: contains no information	

A status byte table with all the possible combinations is printed in the appendix (see Chapter 5.1).

31 Status – Status of comfort mode (EIS 1: 1 Bit)
The Fan Coil Controller sends the comfort mode status via the EIB / KNX using this communication object.

Telegram value:	"0":	Comfort mode deactivated
	"1":	Comfort mode activated

32 Input – Window contact (EIS 1: 1 Bit)
The Fan Coil Controller sends the status of the local window contact or the binary input via the EIB / KNX using this communication object.

Telegram value:	"0":	Contact open (input normal)
	"1":	Contact closed (input normal)
	"0":	Contact closed (input inverted)
	"1":	Contact open (input inverted)

33 Switch output – Switch output 1 (EIS 1: 1 Bit)
34 Switch output – Switch output 2 (EIS 1: 1 Bit)
35 Switch output – Switch output 3 (EIS 1: 1 Bit)
These communication objects are used if no fan is connected but any other electrical loads are connected to the switch outputs of the Fan Coil Controller. If the option "local (max. 3 speeds)" is set for the parameter *Type of fan*, incoming telegrams at this communication object are not executed.

The floating outputs of the Fan Coil Controller are switched on or off via these communication objects, for example to control the lighting or an electric heating system.

Telegram value:	"0":	Output off (contact open)
	"1":	Output on (contact closed)

4.2 Description of the parameters

The default values are printed in italics. Additional parameters can be displayed or hidden via the button "Low Access/High Access".
In the following section, all the parameters are described which are available when "High Access" is selected.

4.2.1 Parameter window: "General"

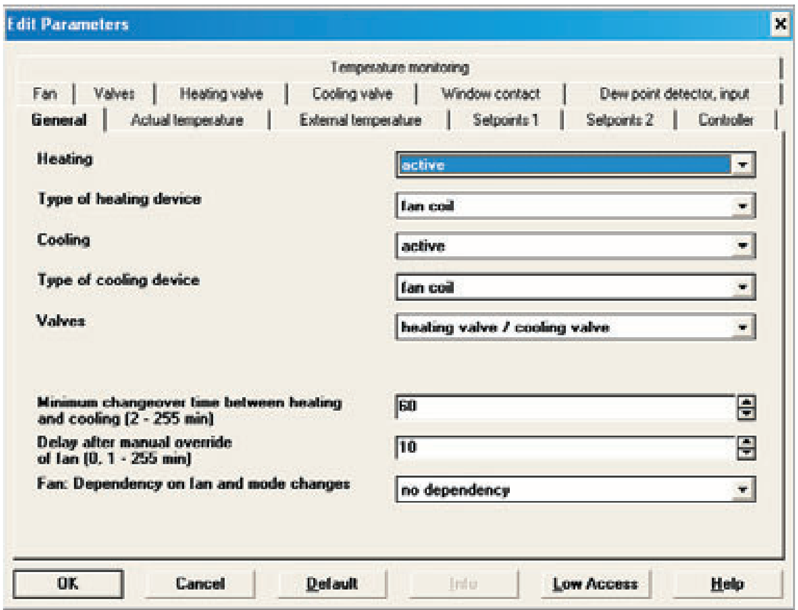


Fig. 22: Parameter window: "General"

Heating
Cooling
Options: – *active*
– disabled

Activation or deactivation of the heating and cooling function of the Fan Coil Controller. If the option “active” is selected, the parameters “Type of heating device” or “Type of cooling device” and “Valves” appear as well as the parameter windows “External temperature”, “Heating valve”, “Cooling valve” and “Dew point detector, input” appear.

Type of heating device
Type of cooling device
Options: – *fan coil*
– convector

Setting the type of heating valve or cooling valve. If the option “convector” is selected, only the valves are regulated via the Fan Coil Controller.
A fan is not connected. The floating contacts can be used for switching other electric loads via the EIB / KNX.

Valves
Options: – *heating valve / cooling valve*
– 1 common valve (heating and cooling)

It can be set via this parameter whether the heating and the cooling circulation loops are controlled via separate valves (e.g. 4-pipe system) or via a common valve (e.g. 2-pipe system).

Minimum changeover time between heating and cooling
Options [min.]:– 2...255 *(60)*

Setting the minimum pause in minutes when toggling between heating mode and cooling mode.

Delay after manual override of fan
Options [min.]:– 0...255 *(10)*

Setting the period in minutes, after which the fan is reset to automatic mode after the last telegram at the communication object “Fan – Manual operation of fan”.

Fan: Dependency on fan and mode changes
Options: – *no dependency*
– switch fan to automatic on mode change
– switch to comfort mode on manual fan

Setting the connection between the fan and the operation mode.
If the option “switch fan to automatic on mode change” is selected, fan control is automatically switched to automatic mode when the operation mode changes (e.g. between comfort and standby mode).

If the option “switch to comfort mode on manual fan” is selected, the operation mode is toggled automatically on receipt of a telegram at the communication object “Fan – Manual operation of fan”. If the value “0” is received, standby mode is activated while comfort mode is activated on receipt of a value that is not equal to “0”.

4.2.2 Parameter window: "Actual temperature"

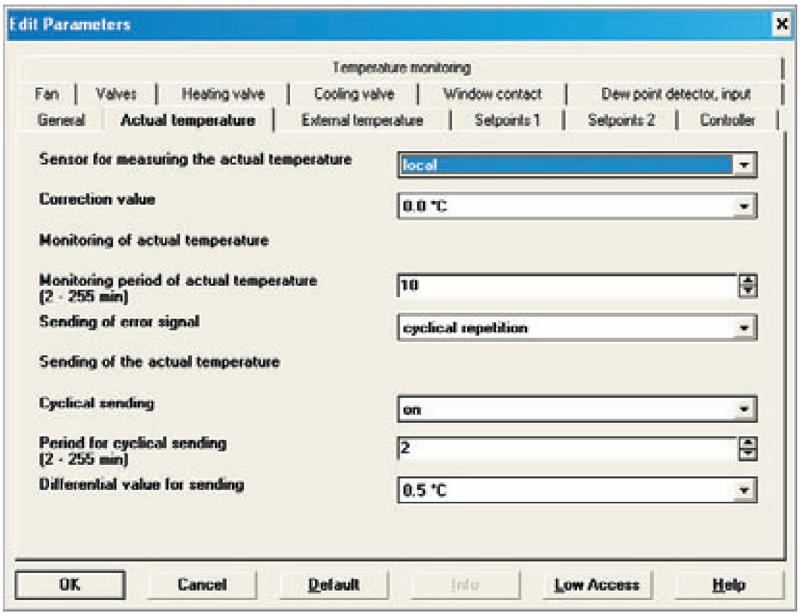


Fig. 23: Parameter window: "Actual temperature"

Sensor for measuring the actual temperature
Options: – *local*
– via EIB

Setting the temperature sensor. If the temperature sensor TS/K 1.1 is connected to the Fan Coil Controller, the option "local" must be selected. In this case, the three parameters for *Sending of the actual temperature* become visible. If the temperature is received via the EIB / KNX, the option "via EIB" must be set.

Correction value
Options [°C]: – -3,0...3,0 *(0,0)*

Correction of the value measured by the temperature sensor TS/K 1.1 or the actual value received via the EIB / KNX.

Monitoring period of actual temperature
Options [min.]:– 2...255 *(10)*

Setting the monitoring period for the actual temperature (local and via the EIB / KNX).

If a sensor value is received via the EIB / KNX, the monitoring period should be selected so that it is at least twice as long as the cyclical transmission period of the sensor so that an error message is not sent immediately when a signal fails to appear.

If the actual temperature is not received, the Fan Coil Controller regulates the heating valve according to the parameterised *Control value (heating) when actual temperature is absent or in event of frost* (parameter window "Temperature monitoring").

Sending of error signal
Options: – no repetition
– *cyclical repetition*

For setting the send repetition in the event of an error message. If the option "no repetition" is selected, the error signal is only sent if there is a change in the object value. If the option "cyclical repetition" is set, the object value is sent according to the parameterised *Period for cyclical sending* for the *Sending of the actual temperature*.

Sending of the actual temperature
Cyclical sending
Options: – *on*
– off

Activation of the cyclical transmission function for the actual temperature. This parameter is only visible if the option "local" is set for the parameter *Sensor for measuring the actual temperature*.

Period for cyclical sending
Options [min.]:– 2...255 *(2)*

Setting the cyclical transmission period for the actual temperature. This parameter is only visible if the option "on" is selected for the parameter *Cyclical sending*.

Differential value for sending
Options [°C]: – 0.1...1.0 *(0.5)*

Setting the temperature change at which the actual temperature is sent in addition to being sent after a change in value. This parameter is only visible if the option "local" has been set for the parameter *Sensor for measuring the actual temperature*.

4.2.3 Parameter window: "External temperature"

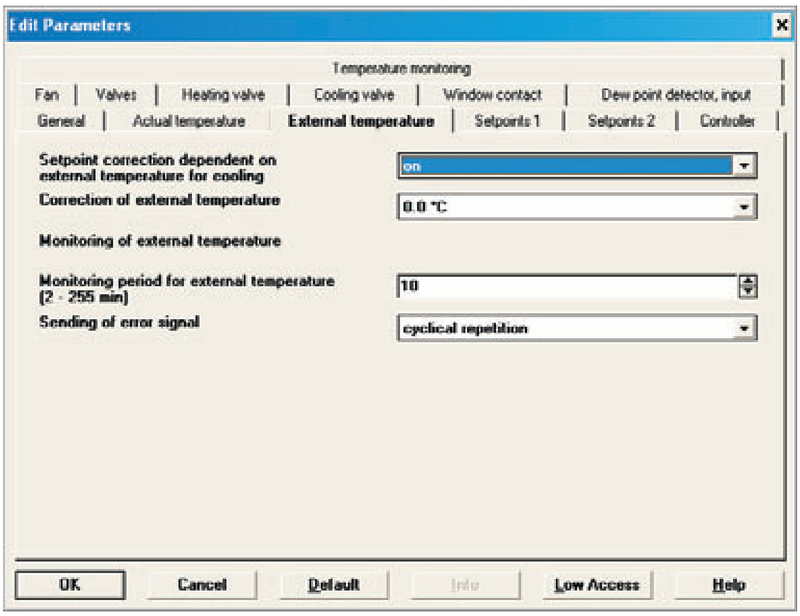


Fig. 24: Parameter window: "External temperature"

Setpoint correction dependent on external temperature for cooling
Options: – *on*
– off

Adjustment of the setpoint dependent on the external temperature.
If the option "off" is set, the setpoint remains constant, regardless of the external temperature.

If the option "on" is set, the temperature setpoint is adapted with the increase of the external temperature via a parameterised threshold value. The threshold value is set in the parameter *Minimum external temperature for correcting the setpoint* (see parameter window "Setpoints 1").
The adaptation of the setpoint is always 1 °C per 3 °C change in the external temperature.

Example:
The setpoint is 25 °C. The parameterised threshold value is 27 °C.
If the external temperature now increases by 3 °C above the threshold value, i.e. to 30 °C, the setpoint is adapted to 26 °C. If the external temperature rises to over 33 °C, the setpoint is 27 °C etc.

Correction of external temperature
Options [°C]: – -3.0...3.0 *(0.0)*

Correction of the external temperature received via the EIB / KNX.

Monitoring period for external temperature
Options [min.]:– -2...255 *(10)*

Setting the monitoring period for the external temperature. The monitoring time should be selected so that it is at least twice as long as the cyclical transmission time of the sensor so that so that an error message is not sent immediately when a signal fails to appear.

Sending of error signal
Options: – no repetition
– *cyclical repetition*

For setting the transmission event for an error signal. If the option "no repetition" is selected, the error signal is only sent if there is a change in the object value. If the option "cyclical repetition" is set, the object value is sent according to the parameterised *Period for cyclical sending*.

4.2.4 Parameter window: “Setpoints 1”

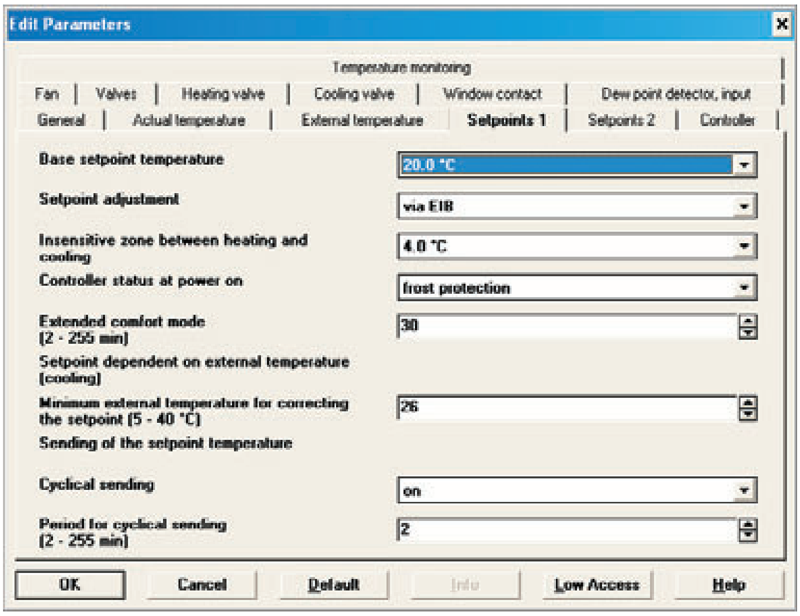


Fig. 25: Parameter window: “Setpoints 1”

Base setpoint temperature
Options [°C]: – 15.0...30.0 *(20.0)*

Setting the base setpoint temperature. The base setpoint temperature can be modified with a telegram to the communication object “Setpoint – Base setpoint temperature”.

Setpoint adjustment
Options: – local
– *via EIB*

Selection of the source for the setpoint adjustment. If the setpoint adjustment is received via a telegram, the option “via EIB” must be set. If the setpoint adjustment is set locally via a potentiometer which is connected to the Fan Coil Controller, the option “locally” must be set.

Insensitive zone between heating and cooling
Options [°C]: – 0.5...6.0 *(4.0)*

Setting the insensitive zone in degrees centigrade. A small insensitive zone increases the control precision i.e. an optimum achievement of the setpoint temperature. A large insensitive zone enables higher energy savings due to less frequent toggling between heating and cooling.

Controller status at power on
Options: – standby mode
– comfort mode
– night setback
– *frost protection*

Setting of the operation mode when connecting the supply voltage.

Extended comfort mode
Options [min.]:– 2...255 *(30)*

Setting the duration of the comfort extension mode. If the device has been switched from comfort mode to night setback, the comfort extension is activated for the parameterised time by a telegram to the communication object "Mode selection – ON command for comfort, comfort extension" and then switched back automatically to night setback.

Setpoint dependent on external temperature (cooling)
Minimum external temperature for correcting the setpoint
Options [°C]: – 5...40 *(26)*
For setting a threshold value for the external temperature. If this threshold value is exceeded, the temperature setpoint is adapted with the increase of the external temperature. This parameter is only visible if the option "on" is set for the parameter *Setpoint correction dependent on external temperature for cooling* (see parameter window "External temperature").

The adaptation of the setpoint is always 1 °C per 3 °C change in the external temperature.

Example:
The setpoint is 25 °C. The parameterised threshold value is 27 °C. If the external temperature now increases by 3 °C above the threshold value, i.e. to 30 °C, the setpoint is adapted to 26 °C. If the external temperature rises to over 33 °C, the setpoint is 27 °C etc.

Sending of the setpoint
Cyclical sending
Options: – *on*
– off

Activation of the cyclical transmission function for the setpoint temperature.

Period for cyclical sending
Options [min.]:– 2...255 *(2)*

Setting the cyclical transmission period for the setpoint temperature.
This parameter is only visible if the option "on" has been set in the parameter *Cyclical sending.*

4.2.5 Parameter window: “Setpoints 2”

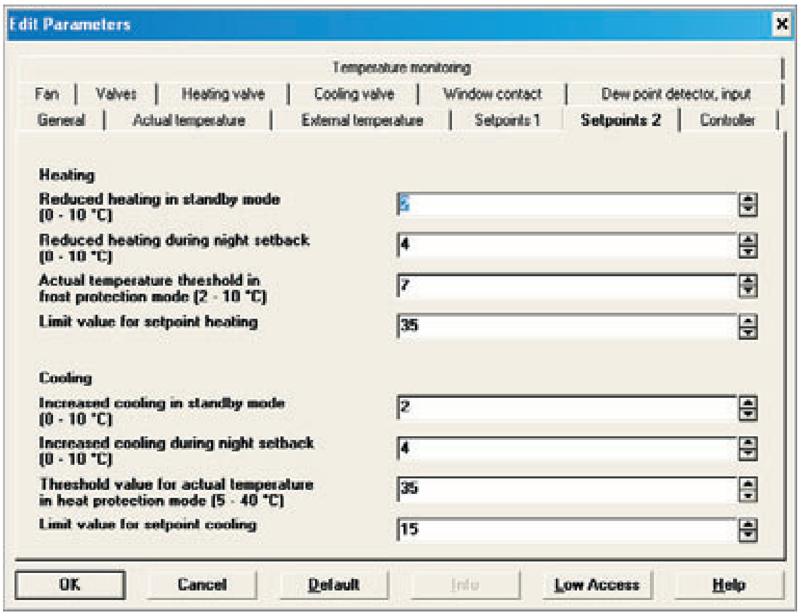


Fig. 26: Parameter window: “Setpoints 2”

Reduced heating in standby mode
Increased cooling in standby mode
Options [°C]: – 0...10 *(2)*

For setting the temperature reduction when heating in standby mode or the temperature increase when cooling in standby mode. The reduction or increase in temperature is calculated starting with the base setpoint temperature.

Reduced heating during night setback
Increased cooling during night setback
Options [°C]: – 0...10 *(2)*

For setting the temperature reduction when heating during night setback or the temperature increase when cooling during night setback. The reduction or increase in the temperature is calculated starting with the base setpoint temperature.

Actual temperature threshold in frost protection mode
Actual temperature threshold in heat protection mode
Options for frost protection [°C]: – 2...10 *(7)*
Options for heat protection [°C]: – 5...40 *(35)*

Frost protection mode: Setting the minimum frost protection temperature. When this temperature is reached, the heating is automatically turned up to prevent the temperature falling below the threshold value.

Heat protection mode: Setting the maximum heat protection temperature. When this temperature is reached, the cooling is automatically switched on to prevent the threshold value from being exceeded.

Limit value for setpoint heating
Limit value for setpoint cooling
Options for heating [°C]: – 5...60 *(35)*
Options for heat protection [°C]: – 5...60 *(15)*

Heating: Setting the maximum setpoint temperature for heating. The room is not heated above this temperature.

Cooling: Setting the minimum setpoint temperature for cooling. The room is not cooled below this temperature.

4.2.6 Parameter window: "Controller"

⚠ Only select the option "user-defined" for the parameters *Controller setting for heating* and *Controller setting for cooling* if you have sufficient knowledge in heating and cooling technology so that the appropriate settings are carried out correctly. The options "slow", normal" and "fast" are suitable for standard applications.

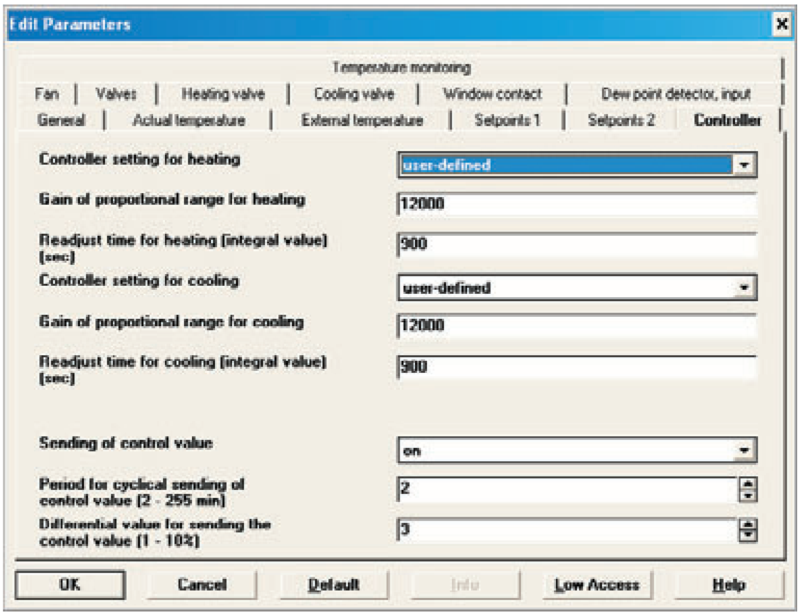


Fig. 27: Parameter window: "Controller"

Controller setting for heating
Controller setting for cooling
Options: – slow
– *normal*
– fast
– user-defined

Setting the PI controller response for heating or cooling.

Gain of proportional range for heating
Readjust time for heating (integral value) [sec.]
Gain of proportional range for cooling
Readjust time for cooling (integral value) [sec.]
Options for proportional range: – 0...65,535 *(12,000)*
Options for readjust time: – 0...65,535 *(900)*

Setting the PI controller. This parameter is only visible if the option "user-defined" is set for the parameters *Controller setting for heating* or *Controller setting for cooling*.

Sending of control value
Options: – *off*
– on

Sending of the control value on the EIB / KNX via the communication object "Controller – Control value for PI controller".

Period for cyclical sending of control value
Options [min.]:– 2...255 *(2)*

Setting the cyclic transmission time for the control value.
This parameter is only visible if the option "on" is set for the parameter *Sending of control value*.

Differential value for sending the control value
Options [%]:– 1...10 *(3)*

Setting the differential value at which the control value is sent in addition to the cyclical sending. This parameter is only visible if the option "on" has been set for the parameter *Sending of control value*.

4.2.7 Parameter window: "Fan"

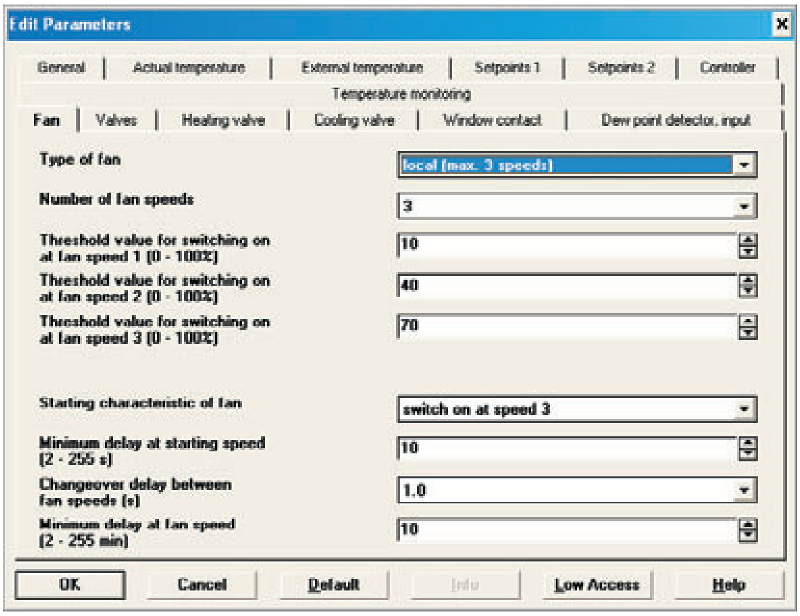


Fig. 28: Parameter window: "Fan"

Type of fan
Options: – no fan
– *local (max. 3 speeds)*
– EIB: on/off
– EIB: 3 speeds
– EIB: 0...100 %

Setting the fan type. The option “local (max. 3 speeds)” is selected if a fan is controlled via the floating outputs of the Fan Coil Controller. The option “EIB: …” is selected if a fan is controlled via the EIB / KNX e.g. via a switch actuator or an analogue actuator.

Number of fan speeds
Options: – 1
– 2
– *3*

Setting the number of fan speeds. This parameter is only visible if the option “local (max. 3 speeds)”, “EIB: 3 speeds” or “EIB: 0…100 %” has been selected for the parameter *Type of fan*.

Threshold value for switching on at fan speed 1
Threshold value for switching on at fan speed 2
Threshold value for switching on at fan speed 3
Options [%]:– 0...100 *(10, 40, 70)*

Setting the threshold values for the automatic toggling of the fan speed dependent on the control value of the controller. This parameter is only visible if the option “local (max. 3 speeds)”, “EIB: 3 speeds” or “EIB: 0…100 %” has been selected for the parameter *Type of fan*.

Starting characteristic of fan
Options: – switch on at speed 1
– switch on at speed 2
– *switch on at speed 3*

Setting the speed at which the fan switches on. To ensure that the fan motor starts reliably, it is advisable to start at a higher speed initially, depending on the type, in order to maintain a higher torque at start-up. Once the *Minimum delay at starting speed* has elapsed, the fan is switched to the speed that corresponds to the control value. Fig. 28 shows an example of the response for the option “switch on at speed 3”.

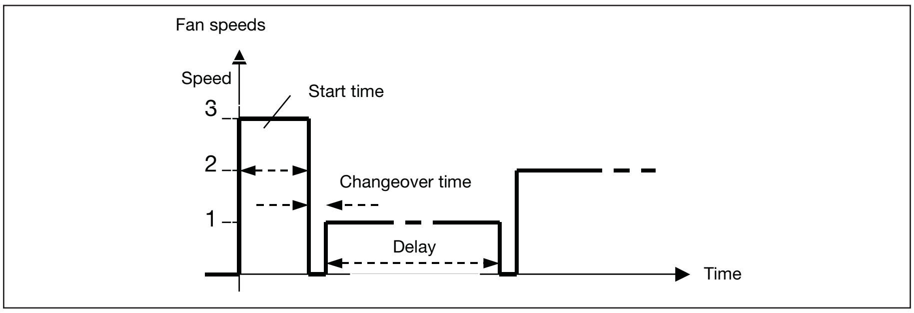


Fig. 29: Switch fan on at speed 3

This parameter is only visible if the option “local (max. 3 speeds)” or “EIB: 3 speeds” has been set for the parameter *Type of fan*.

Minimum delay at starting speed
Options [sec.]:– 2...255 *(10)*

Setting the minimum delay at the starting speed. This parameter is only visible if the option "local (max. 3 speeds)" or "EIB: 3 speeds" has been set for the parameter *Type of fan*.

Changeover delay between fan speeds
Options [sec.]:– 0.5...10 *(1)*

Setting the changeover delay between the fan speeds. This parameter is only visible if the option "local (max. 3 speeds)" or "EIB: 3 speeds" has been set for the parameter *Type of fan*.

Minimum delay at fan speed
Options [sec.]:– 2...255 *(10)*

Setting the minimum delay at a fan speed. This parameter should be selected so that a fault is avoided by changing over the fan speed too frequently. This parameter is only visible if the option "local (max. 3 speeds)" or "EIB: 3 speeds" has been set for the parameter *Type of fan*.

4.2.8 Parameter window: "Valves"

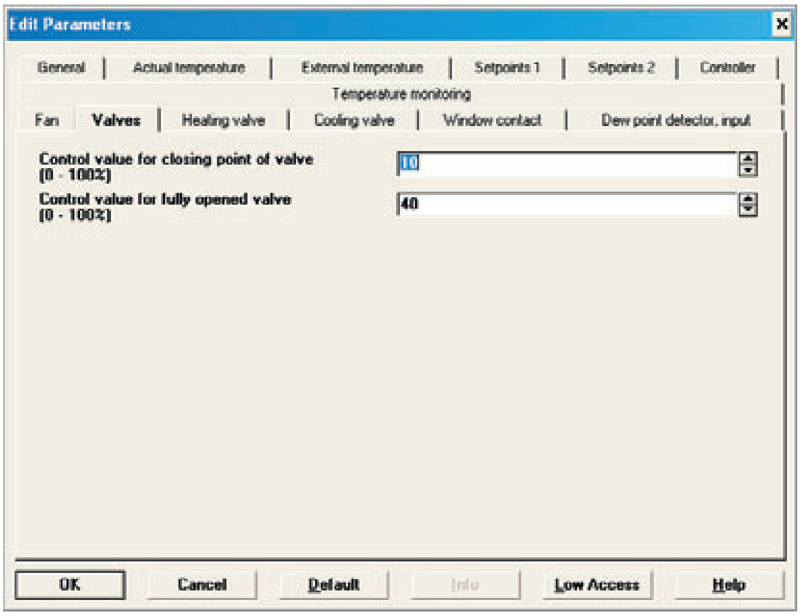


Fig. 30: Parameter window: "Valves"

Control value for closing point of valve
Control value for fully opened valve
Options [%]:– 0...100 *(10, 40)*

Adjustment of the valve characteristic curve by the limitation of the control value of the valve. In the lower and upper ranges, the valve output does not react to the control value. A valve movement can thus be avoided when there is a negligible demand for heating or cooling.

4.2.9 Parameter window: “Heating valve” or “Cooling valve”

The parameter windows “Heating valve” and “Cooling valve” are largely similar. Only the default values for the cycle time differ from each other.

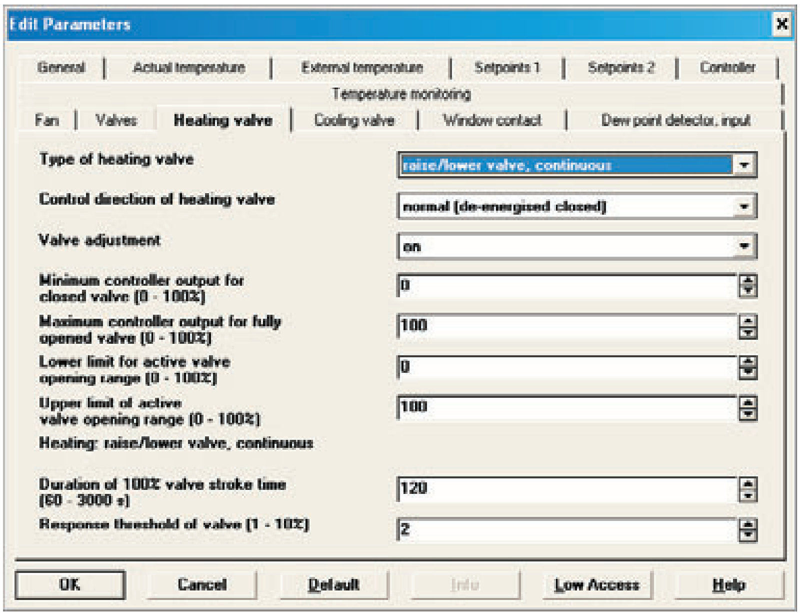


Fig. 31: Parameter window: “Heating valve”

Type of heating valve
Type of cooling valve

Options:
- *raise/lower valve, continuous*
- raise/lower valve, pulse width modulation
- thermal valve
- EIB valve, continuous
- EIB valve, pulse width modulation

Setting the valve type. The option “EIB …” is selected if a valve is controlled via the EIB / KNX e.g. via an electronic actuator. The other options are available for selection if the valve is controlled via the heating/cooling outputs of the Fan Coil Controller.

Control direction of heating valve
Control direction of cooling valve

Options:
- *normal (de-energised closed)*
- inverted (de-energised open)

Setting the control direction of the valve.

Valve adjustment

Options:
- *off*
- on

User-defined adjustment of the valve characteristics. If the option “on” is selected, the parameters for a user-defined adjustment of the valve characteristics appear.

⚠ Only select the option “on” if you have sufficient knowledge in heating and cooling technology so that the appropriate settings are carried out correctly. The option “off” is suitable for standard applications.

Minimum controller output for closed valve
Maximum controller output for fully opened valve
Lower limit for active valve opening range
Upper limit for active valve opening range
Options [%]:– 0...100 *(0, 100)*

For setting the valve characteristic curve i.e. the valve position dependent on the control value. These parameters are only visible if the option “on” has been set for the parameter Valve adjustment.

The maximum set control value range (parameters *Control value for closing point of valve* and *Control value for fully opened valve* in the “Valves” parameter window) can be further limited by this parameter.

Heating: raise/lower valve, continuous
Duration of 100 % valve stroke time
Options [sec.]:– 60...3,000 *(120)*

Setting the period which the valve drive requires for a complete valve lift. This parameter is only visible if the option “raise/lower valve, continuous” or “raise/lower valve, pulse width modulation” has been set for the parameter *Type of heating valve* or *Type of cooling valve*.

Response threshold of valve
Options [%]:– 1...10 *(2)*

Setting the change in the control value at which the valve position should be adapted to the control value. The larger the parameterised value that is selected, the less frequently the valve needs to be positioned.

This parameter is only visible if the option “raise/lower valve, continuous” has been set for the parameter *Type of heating valve* or *Type of cooling valve*.

Cycle time for heating valve
Cycle time for cooling valve
Options for heating valve [min.]: – 1...255 *(25)*
Options for cooling valve [min.]: – 1...255 (15 local, *10 otherwise*)

For setting the duration of the pulse-width modulated signal for converting the control value into the valve position. The larger the parameterised value that is selected, the less frequently the valve needs to be positioned. Temperature regulation however becomes more inaccurate with a larger value.

This parameter is only visible if the option “raise/lower valve, pulse width modulation”, “EIB valve, pulse width modulation” or “thermal valve” has been set for the parameter *Type of heating valve* or *Type of cooling valve*.

Period for cyclical sending of control value
Options [min.]:– 2...255 *(2)*

Setting the cyclic transmission period for the control value. This parameter is only visible if the option “EIB valve, continuous” has been set for the parameter *Type of heating valve* or *Type of cooling valve*.

Differential value for sending the control value
Options [min.]:– 2...255 *(3)*

Setting the differential value at which the control value is sent in addition to the cyclical sending. This parameter is only visible if the option “EIB valve, continuous” has been set for the parameter *Type of heating valve* or *Type of cooling valve.*

4.2.10 Parameter window: “Window contact”

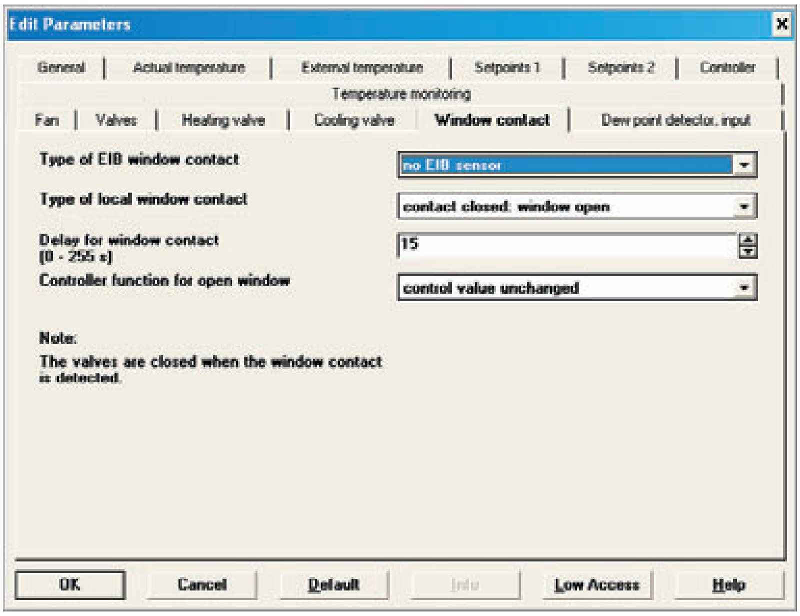


Fig. 32: Parameter window: “Window contact”

Type of EIB window contact
Options: – *no EIB sensor*
– normal
– inverted

Setting an EIB / KNX window contact.

Type of local window contact
Options: – no local sensor
– *contact open: window open*
– contact closed: window open
– Input: normal
– Input: inverted

Setting a local window contact or a binary input. The options “contact open: window open” and “contact closed: window open” are used for a window contact. In the case of a window contact, the *Controller function for open window* is executed when the contact is closed or opened. The status is reported via the EIB (communication object “Window contact – Input for window contact”).

The options “Input: normal” and “Input: inverted” are used for a binary input. The status is reported via the EIB (communication object “Window contact – Input for window contact”). No control is carried out in addition.

Delay for window contact
Options [s]: – 0...255 *(15)*

Delay when the window is opened temporarily. The *Controller function for open window* is only deactivated once the parameterised delay has elapsed. The delay functions both for an EIB / KNX window contact and a local window contact.

Controller function for open window
Options: – normal (active)
– control value = 0 (all off)
– *control value unchanged*

Reaction when the window is opened. If the option “control value unchanged” is selected, the control value remains unchanged until the window is closed again. The control value is then recalculated and the valve position is adjusted.

If the option “normal (active)” is selected, the current control value is continually calculated in spite of the open window and the valve position is adjusted. If the option “control value = 0 (all off)” is selected, the valve is closed. The frost protection function or heat protection function is activated.

4.2.11 Parameter window: “Dew point detector, input”

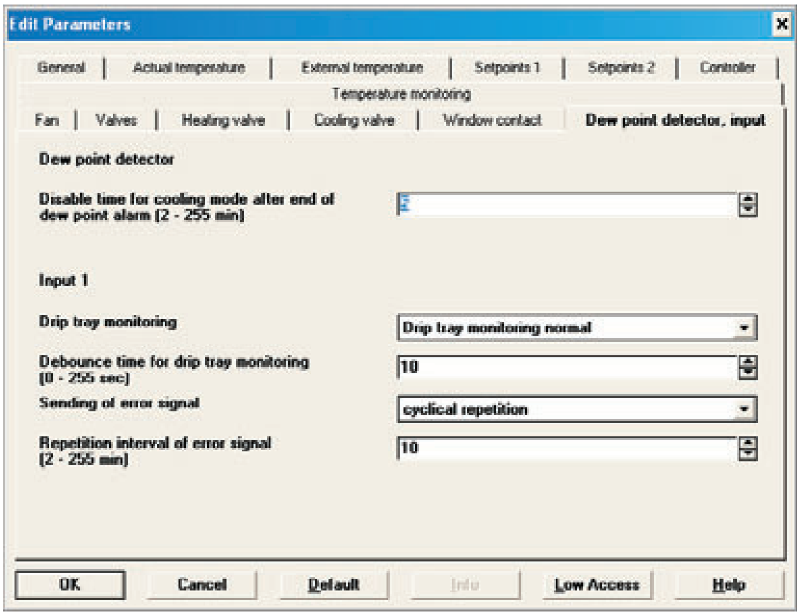


Fig. 33: Parameter window: “Dew point detector, input”

Disable time for cooling after end of dew point alarm
Options: – 2...255 *(5)*

Setting the disable time for cooling after the end of a dew point alarm.

Input 1
Drip tray monitoring
Options: – *none*
– Drip tray monitoring normal
– Drip tray monitoring inverted
– Input normal
– Input inverted

For setting the local drip tray overflow contact or a binary input.
The options “Drip tray monitoring normal” and “Drip tray monitoring inverted” are used for a drip tray overflow detector. When this detector is triggered, the *Disable time for cooling after end of dew point alarm* is retained. The status is reported via the EIB (communication object “Drip tray overflow – Drip tray overflow signal”).

The options “Input normal” and “Input inverted” are used for a binary input. The status is reported via the EIB (communication object “Input 1 – Input 1”). No control is carried out in addition.

Debounce time for drip tray monitoring
Debounce time
Options [sec.]: – 0...255 *(2)*

For setting the debounce time of the local drip tray overflow contact or an EIB dew point detector.

Floating contacts are preferably used for drip tray monitoring.
Slow wave movements can be produced in the drip tray due to external vibrations which lead to a continuous opening and closing of the contact. This effect can be counteracted using a debounce time of an appropriate length.

Sending of error signal
Options: – no repetition
– *cyclic repetition*

Activation of the cyclical transmission function for a drip tray overflow signal (communication object “Drip tray overflow – Drip tray overflow signal”).
This parameter is only visible if the option “Drip tray monitoring normal” or “Drip tray monitoring inverted” has been set for the parameter *Drip tray monitoring*.

Repetition interval of error signal
Options [min.]: – 2...100 *(10)*

For setting the cyclic transmission time for a drip tray overflow signal (communication object “Drip tray overflow – Drip tray overflow signal”).
This parameter is only visible if the option “Drip tray monitoring normal” or “Drip tray monitoring inverted” has been set for the parameter *Drip tray monitoring.*

4.2.12 Parameter window: "Temperature monitoring"

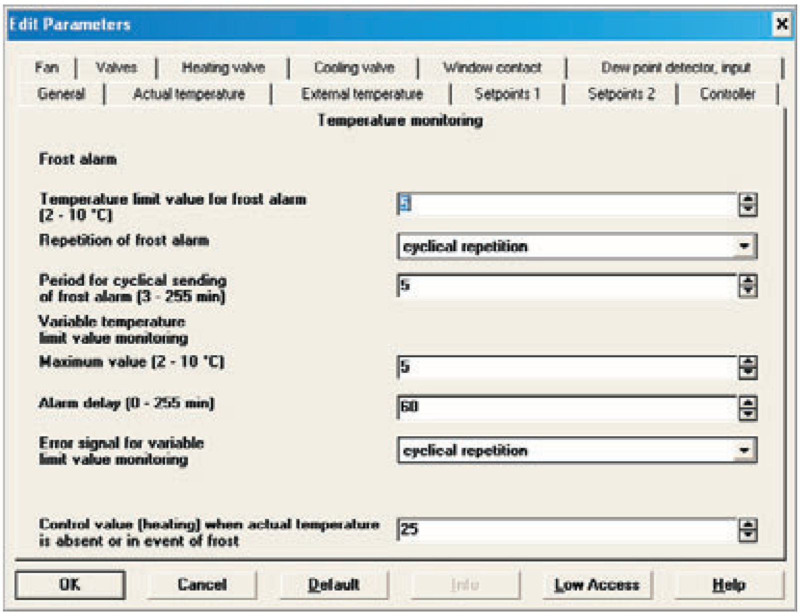


Fig. 34: Parameter window: "Temperature monitoring"

Frost alarm
Temperature limit value for frost alarm
Options [°C]: –2...10 *(5)*

Setting the temperature limit value. If the temperature falls below the limit value, the *Control value (heating) when actual temperature is absent* or *in event of frost* is triggered and an alarm signal is sent via the EIB / KNX (communication object "Temperature monitoring – Frost alarm error signal").

Repetition of frost alarm
Options: – no repetition
– *cyclic repetition*

Activation of the cyclic transmission function for the frost alarm.
If the option "cyclic repetition" is set, the object value is sent according to the parameterised *Period for cyclical sending of frost alarm*.

Period for cyclical sending of frost alarm
Options [min.]:–2...255 *(5)*

Setting of the cyclic transmission time for a frost alarm. This parameter is only visible if the option "cyclic repetition" is set for the parameter *Repetition of frost alarm*.

Variable temperature limit value monitoring
Maximum value
Options [°C]: –2...10 *(5)*

Setting of the maximum permitted differential between the actual temperature and the setpoint temperature. When the maximum value is exceeded, an error signal is sent via the EIB / KNX (communication object "Temperature monitoring – Temperature error signal (limit violation)").

Alarm delay
Options [min.]:– 2...*255 (60)*

For setting the delay for sending an error signal when the maximum value is exceeded. If the temperature falls below the maximum value again within the parameterised delay, no error signal is sent.

Error signal for variable limit value monitoring
Options: – no repetition
– *cyclic repetition*

Activation of the cyclic transmission function for variable temperature monitoring. If the option "cyclic transmission" is set, the object value is sent according to the parameterised *Period for cyclical sending of frost alarm*.

Control value (heating) when actual temperature is absent or in event of frost
Options [%]: – 0...100 *(25)*

Setting the control value in frost protection mode. This control value is set if the value falls below the temperature limit value for frost alarm or the actual temperature is not received within the parameterised cyclic period.

5 Appendix

5.1 Status byte tables

5.1.1 Communication object "Error signal – Error information"

Bit no.		7	6	5	4	3	2	1	0
Status byte value	Hexadecimal	free	free	free	free	Temperature monitoring	Frost alarm	External temperature error	Actual temperature error
0	00								
1	01								+
2	02							+	
3	03							+	+
4	04						+		
5	05						+		+
6	06						+	+	
7	07						+	+	+
8	08					+			
9	09					+			+
10	0A					+		+	
11	0B					+		+	+
12	0C					+	+		
13	0D					+	+		+
14	0E					+	+	+	
15	0F					+	+	+	+

5.1.2 Communication object "Status – Status of fan coil controller"

Bit no.		7	6	5	4	3	2	1	0
Status byte value	Hexadecimal	free	free	free	free	Drip tray overflow	Window open	Cooling active	Heating active
0	00								
1	01								+
2	02							+	
3	03							+	+
4	04						+		
5	05						+		+
6	06						+	+	
7	07						+	+	+
8	08					+			
9	09					+			+
10	0A					+		+	
11	0B					+		+	+
12	0C					+	+		
13	0D					+	+		+
14	0E					+	+	+	
15	0F					+	+	+	+

5.2 Ordering information

Description	Ordering information Short code	Erzeugnis-Nr.	bbn 40 16779 EAN	Price group	Unit weight [kg]	Pack unit [pc.]
Fan Coil Controller	**FC/S 1.1**	2CDG 120 001 R0011	**58383 1**	20	0.4	1
Temperature sensor	**TS/K 1.1**	2CDG 120 002 R0011	**58381 7**	20	0.05	1

Description	Ordering information Short code	Order no.	bbn 40 11395 EAN	Price group	Unit weight [kg]	Pack unit [pc.]
Room thermostat, solo, FM	**TUS/U 1.1**	GJ B000 6134 A0157	**04202 1**	17	0.05	1
Room thermostat, alpha nea, FM	**TU/W 1.1**	GJ B000 6134 A0137	**00162 2**	17	0.1	1
Busch-triton switch sensors with room thermostat, FM	**TRITON/3.D.RT.WA.1**	GJ B000 6300 A1224	**98573 1**	17	0.08	1
Busch-triton switch sensors with room thermostat, FM	**TRITON/5.IR.D.RT.WA.2**	GJ B000 6300 A1237	**98942 5**	17	0.15	1
Bus coupler	**BA/U 3.2**	GJ B000 6120 A0065	**03674 7**	17	0.06	1

Notes

Notes

The information in this leaflet is subject to change without further notice.

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replaces 2CDC 508 032 D0202

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