ABB i-bus® KNX
Application manual
Heating/Ventilation/Air Conditioning

Power and productivity
for a better world™

Description of the symbols:

- Sample
- Note
- Tip
- Disadvantage
- Advantage
- Important

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General

ABB i-bus® systems offer an attractive solution, which fulfils the highest standards in residential, commercial and public buildings. Quality of living, comfort and safety can be easily combined with cost-effectiveness and environmental awareness using ABB i-bus® systems.
The ABB i-bus® products cover the entire range of applications in buildings: from illumination and blind control to heating, ventilation, energy management, security and surveillance.
These demands can be realised cost-effectively with minimal planning and installation effort using the ABB i-bus®. Furthermore, the flexible usage of rooms and the continuous adaptation to changing requirements are easy to implement.
Important for the realisation of the elevated demands of building users is however, professional and detailed planning. This application manual – from practical applications for practical usage – is intended to facilitate planning and realization of a project.

ABB i-bus® KNX application manual Heating/Ventilation/Air-Conditioning

After a brief presentation of the possible functions in the area of Heating/Ventilation/Air-Conditioning, the available sensors and actuators are described. The use of blower convectors in conjunction with KNX as well as the topic of ventilation will be examined.
The following chapters deal with time-dependent and occupancy-dependent temperature control.

Various special functions, e.g. an additional heating stage, are described in the last chapter.

The selection possibilities of the individual control functions and their combination possibilities are very comprehensive. The checklist from ABB has proven to be very useful for simplification of the engineering involved.

A checklist template can be found in the Appendix.

The application manual is intended for persons who already have acquired basic knowledge in ABB i-bus® KNX (basic functions, topology, addressing, …), e.g. in a certified ABB i-bus® KNX training session.

1. Introduction

The predominant application for heating, ventilation and temperature control with KNX is in the area of roomoriented temperature control or individual room temperature control. By detecting the actual temperature value and specifying a respective temperature setpoint with a control algorithm, the thermostat sends a control value to the actuator. This actuator controls a heating or cooling unit that changes the room temperature.
The prerequisite is a water-based heating and cooling system. KNX generally has no influence on this centrally controlled system. Some manufacturers already provide KNX-based solutions for communication between the individual rooms and the central control unit, e.g. Buderus and Viessmann. As these are manufacturer-specific solutions, we will not be referring to them in this application manual.
However, the range of KNX-based products and solutions for HVAC applications continues to grow. Many innovations are expected in the near future in this field.
It is useful to undertake preliminary considerations when planning a project. This includes the selection of the devices as well as the control and special functions.

1.1. Selection of the devices and the required control and special functions

HVAC-control with ABB i-bus® is characterised by a high level of flexibility. This includes a large range of individual devices, the control and special functions as well as their combination possibilities.

Introduction

The following devices and functions are available:

Device selection

- Overview of KNX sensors for room temperature control
  - Room thermostat without display
  - Room thermostat with display

- Overview of KNX actuators for room temperature control
  - Room thermostat with electromotor valve drive
  - Room thermostat with electrothermal valve drive

- Blower convectors (Fan Coil Units)
- Ventilation

Control functions

- Timer control
- Occupancy control

Special functions

- Temperature control with blower convectors and temperature detection independent of KNX thermostats
- Temperature control with window contacts
- Additional HEATING/COOLING stages
- Communication between electromotor valve drives
- Maintenance of blower convector filters
- Valve purging

2. Device selection

2.1 Which devices/applications are available in practice in conjunction with KNX?

- Both cooling and heating functions are implemented.
- Convectors, floor heating, cooling ceilings, and less frequently, electrical heating systems are used.
- Fan Coil Units can also be used; for control purposes, either special actuators (FCA/S 1.1M) or switch actuators with a matched application are used.
- Generally, a KNX thermostat (alpha *nea*®, Busch-*triton*®, Busch-*priOn*® or solo® as well as the Room Thermostat Fan Coil with Display RDF/A 1.1) are used. The Controlpanel as well as the Busch-*ComfortTouch*® may also be used as thermostats. Busch-*priOn*® and Busch-*ComfortTouch*® in combination offer a further solution, see chapter 2.2.2.5.
- The actuators that are used are switch actuators and electronic actuators that each feature electrothermal valve drives or direct electromotor valve drives with KNX connection.
- A special solution is the use of the Universal Interface US/U x.2 with electronic relays and electrothermal valve drives.
- Special solutions such as the use of KNX-enabled boilers, implementation of central control functions with an analogue input or output and separate control modules etc., are not dealt with in this chapter.

For further information see Heating, Air-conditioning and Ventilation Control with EIB, chapter 4.2.

2.2. Overview of KNX sensors for room temperature control

Thermostats as well as comfortable panels with integrated thermostats are available for room temperature control using KNX sensors.

2.2.1. Room thermostat without display

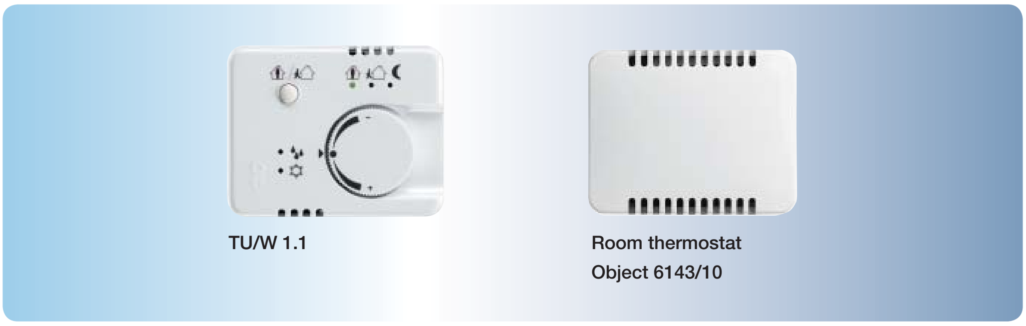

Fig. 1: Room thermostat without display

The room thermostats alpha *nea*® and commercial offer in principle the same software functionality. However, the commercial version purposely does not include operating features such as operating mode or setting adjustments on the device. Accordingly, these thermostats are ideally suited for projects, where on-site operation is not desired, e.g. in schools and other public buildings.

2.2.2. Room thermostat with display

2.2.2.1. Room thermostat Busch-*triton*®

Fig. 2: Busch-*triton*®

In principle, the Busch-*triton*® thermostat offers the same software functionality as the alpha *nea*® and commercial thermostats.

Device selection

2.2.2.2. Room Thermostat solo®

Fig. 3: solo®

The room thermostats solo® TUS/U 1.3. and 2.3. have very high-performance functionality, and the software is comparable with the ABB i-bus® KNX device RDF/A 1.1, see the following explanation chapter 2.2.2.4.

> ✱ Both thermostats solo® require a new generation of the Bus Coupler BA/U 5.1.

2.2.2.3. Room Thermostat Busch-*priOn*®

Fig. 4: Busch-*priOn*®

In the Busch-*priOn*® with display and rotary button operation, the function room temperature control is already integrated into the software. Room temperature control can be easily realized using the optional temperature sensor in the lower end strip.

> ✱ The functionality of the Busch-*priOn*® control element has a very high performance, and the software is comparable with the ABB i-bus® KNX device RDF/A 1.1.
> However, the Busch-*priOn*® control element requires the new generation Bus Coupler BA/U 5.1.
> Depending on the configuration of a Busch-*priOn*® control element, the Bus Coupler BA/U 1.24.1 with the additional 24 V Voltage Supply CP/D 24/2.5 are used.

2.2.2.4. Room Thermostat Fan Coil with Display RDF/A 1.1

Fig. 5. RDF/A 1.1

The ABB i-bus® KNX RDF/A 1.1 is specially designed for the control of blower convectors and is externally recognisable by the fan button. In principle, this device can be used for control of classical valves via the corresponding actuators, e.g. for HEATING.

The device represents the state-of-the-art of KNX thermostats. In particular, the software of the RDF/A 1.1 offers some advantages and expansions compared to other devices. The most important are described in the following.

Hardware:
- No separate bus coupler required; accordingly simple surface mounting and lower device costs.
- Neutral design, white plastic and aluminium, in the near future in stainless steel, ensuring combination with other push button designs.
- Simple operation with the respective buttons: ON/OFF and/or switch-over to Standby/Comfort, temperature setpoint UP/DOWN, fan speeds, display switch over of Celsius/Fahrenheit.
- Large display with comprehensive symbols.

Software:
- Mode selector switch, e.g. Comfort, Standby, Economy via 1 byte (a defined value for each mode) or 3 x 1 bit communication objects as with the other components. Advantage of the 1 byte communication object: Jumping directly between operating modes is possible.
- Device internal room temperature measurement and also externally via a separate sensor with weighting of both measured values possible.
  Adjustable subsidiary function without active thermostat, i.e. the RDF/A 1.1 is only used for providing the setpoint, room temperature measurement and specifying the operating mode. Particularly of interest when using the Fan Coil Controller FC/S 1.1, see chapter 4 “Fan Coil Controller FC/S 1.1 with Busch-*triton*®“
- Only COOLING can be parameterised, of particular significance in regions where only cooling is necessary.
- HEATING and COOLING additional stage.
- Selection option: dependent setpoints (as with the classical thermostat) or absolute setpoints.
- Summer- and winter compensation.

For further information see product manual RDF/A 1.1

2.2.2.5. Touch displays with integrated thermostat

Fig. 6: Touch displays with integrated thermostat

Both panels are comparable in terms of the room temperature control function with the integrated control functionality of the Busch-*priOn*® with display. Rooms in which these panels are installed do not require an additional thermostat.

Solution combining Busch-*priOn*® room temperature control together with Busch-*ComfortTouch*®

For the Busch-*priOn*® without Display, it is also possible to measure the room temperature using the optional temperature sensor in the lower end strip.

Fig. 7: Busch-*priOn*® with integrated temperature sensor

For the Busch-*priOn*® without Display (1-fold and 3-fold), no software is available that enables room temperature control. However, the Busch-*ComfortTouch*® can enable via software up to 20 independent control circuits. This means, in conjunction with the distributed temperature detection via the Busch-*priOn*®, many room temperature controls can be implemented cost-effectively without the need to install autonomous room temperature controls in each of the rooms. Of course, the on-site operation and display is somewhat limited however, switch-over between 2 setpoints by button (Standby and Comfort) is possible.

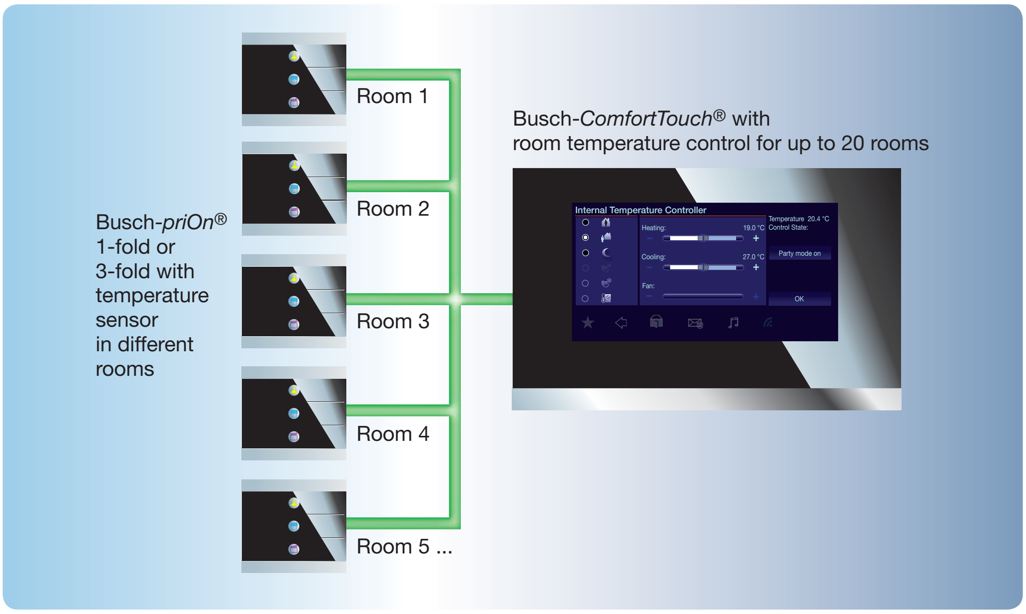

Fig. 8: Room temperature control of different areas with a touch display

2.3. Solution with a conventional thermostat

If a conventional thermostat is to be used instead of a KNX thermostat, this is possible using a thermostat with a switch output. Two-step or PWM control (**P**ulse **W**idth **M**odulation) can be implemented. For this purpose, the contact of the switch output is connected to a binary input via KNX, so that the control value is available on KNX. An actuator and a thermal valve drive control the valve.

> This solution is particularly interesting in conjunction with the ABB i-bus® Room Controller RC/A x.2. If conventional buttons are used for lighting and blinds via binary inputs, a classical thermostat should be used when possible.

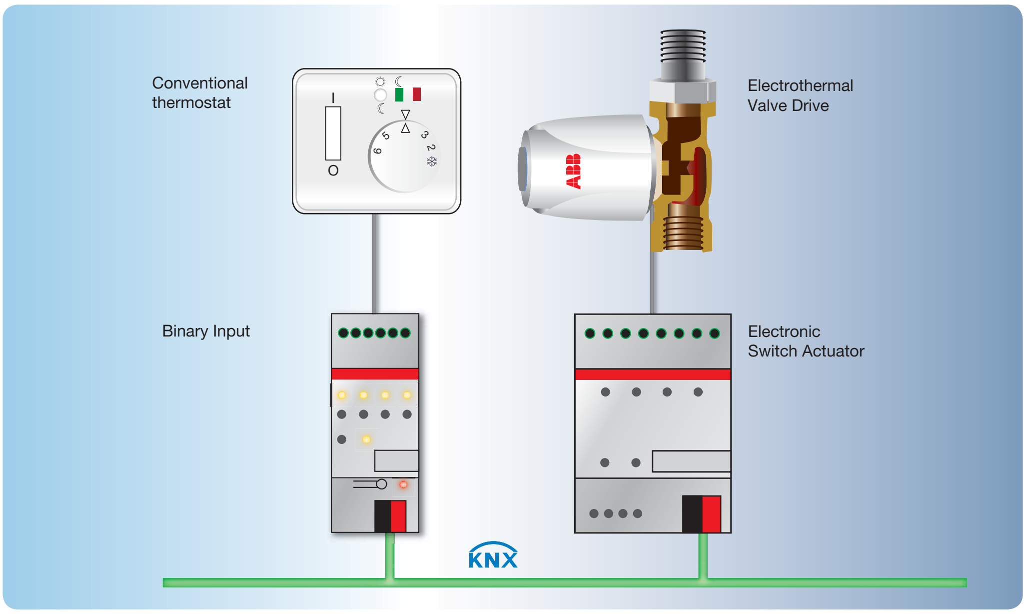

Fig. 9: Conventional thermostat connected with KNX

3. Overview of KNX actuators for room temperature control

Room temperature control with KNX actuators can be implemented using electromotor or electrothermal actuator drives.

3.1. Room thermostat with Electromotor Valve Drive

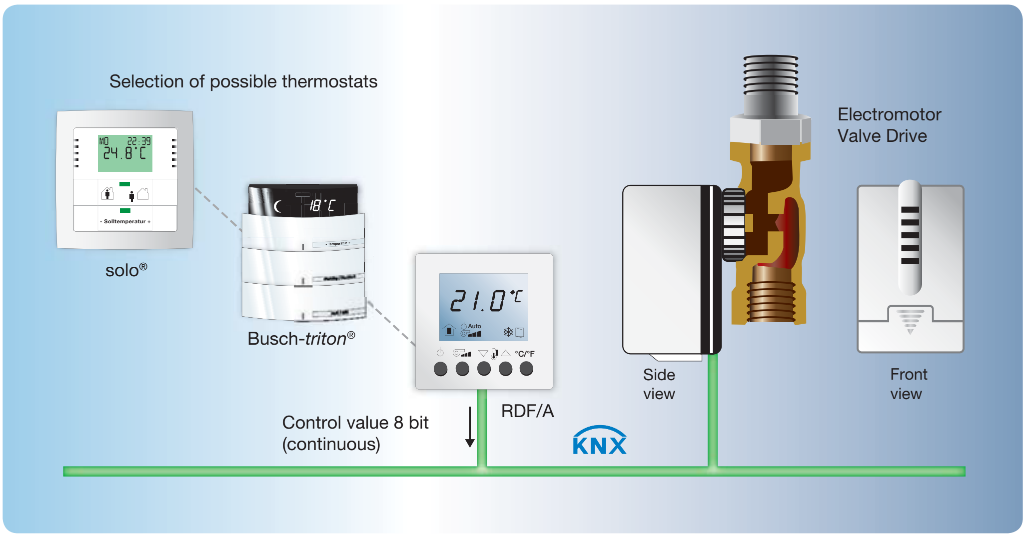

Fig. 10: Room temperature control with electromotor valve drive via KNX

An electromotor valve drive consists of a motor, gearing and electronics.
The water circulation circuit valve is actuated directly via the mechanics of the valve drive ensuring continuous regulation. The voltage supply of the electronics and motor is provided via KNX.

3.2. Room thermostat with Electrothermal Valve Drive

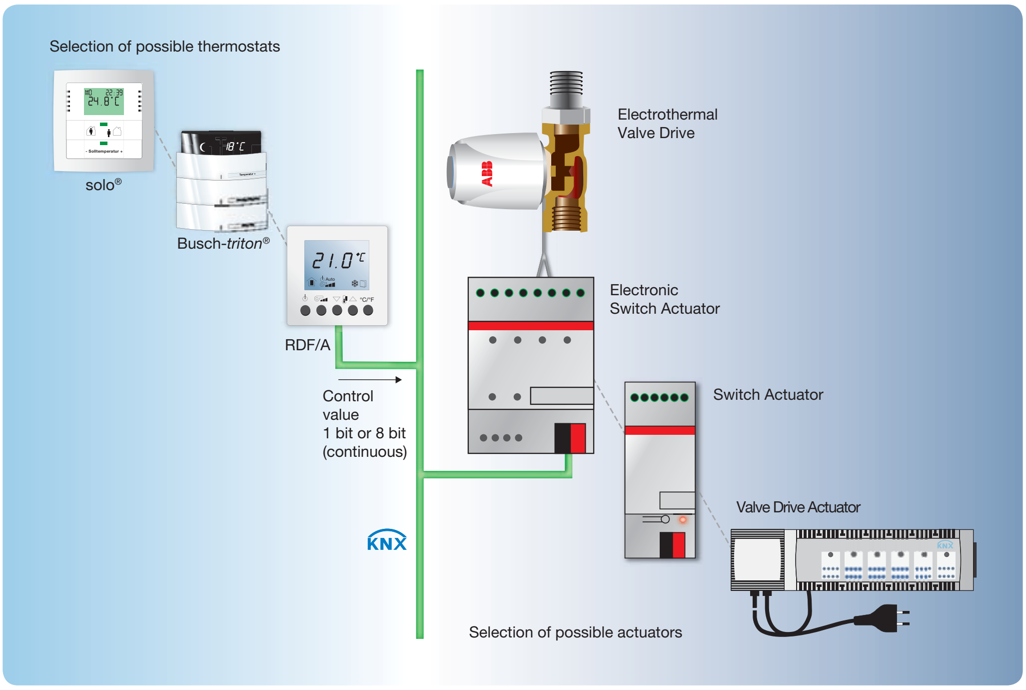

Fig. 11: Room temperature control with electrothermal valve drive via KNX

An electrothermal valve drive consists of a thermal expansion element, e.g. a wax cartridge that heats and expands when an electric voltage is applied. After the voltage is switched off, the element will contract. This will open or close a valve and thus influence the flow of water. The time for opening or closing the valve is two to three minutes.
As a consequence of the system inertia, a valve can also be brought to a partly opened position via a thermal actuator drive through pulse width modulation.

There are versions available for 230 V and 24 V as well as normally closed or normally opened contacts.

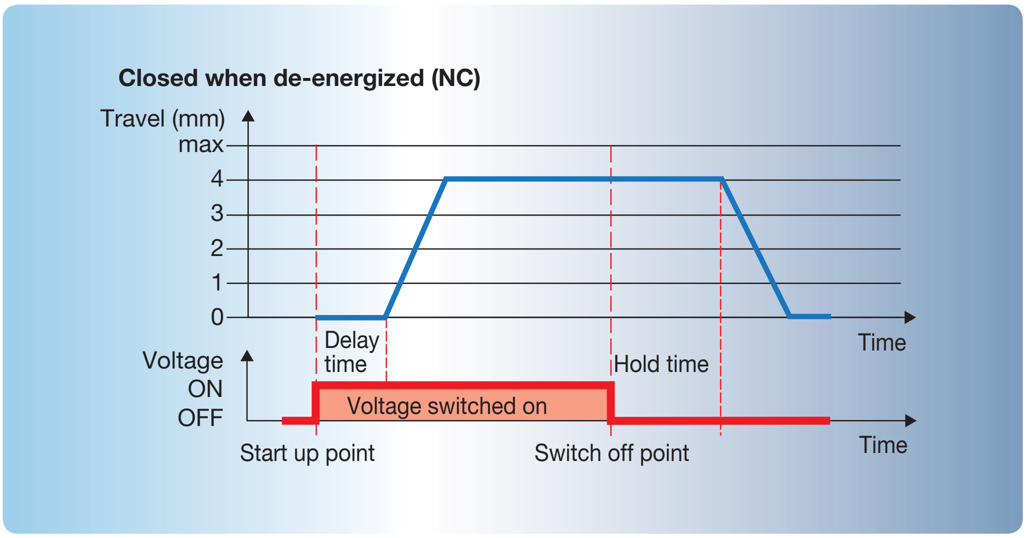

Fig. 12: Characteristic of a normally closed electrothermal valve drive (principle representation)

A further solution is the use of the Universal Interface US/U x.2 with electronic relays and electrothermal valve drives.
The US/U features a HEATING software function similar to the Electronic Actuator ES/S 4.1.1. Using an electronic relay as an amplifier, the US/U can control a thermal valve drive.

> ✱ The channels of the ABB i-bus® Universal Interface US/U x.2 can be parameterised both as an input and an output. For this reason, the term channel will be used in this description.

Overview of KNX actuators for room temperature control

KNX thermostat with US/U x.2, Electronic Relay and Electrothermal Valve Drive:

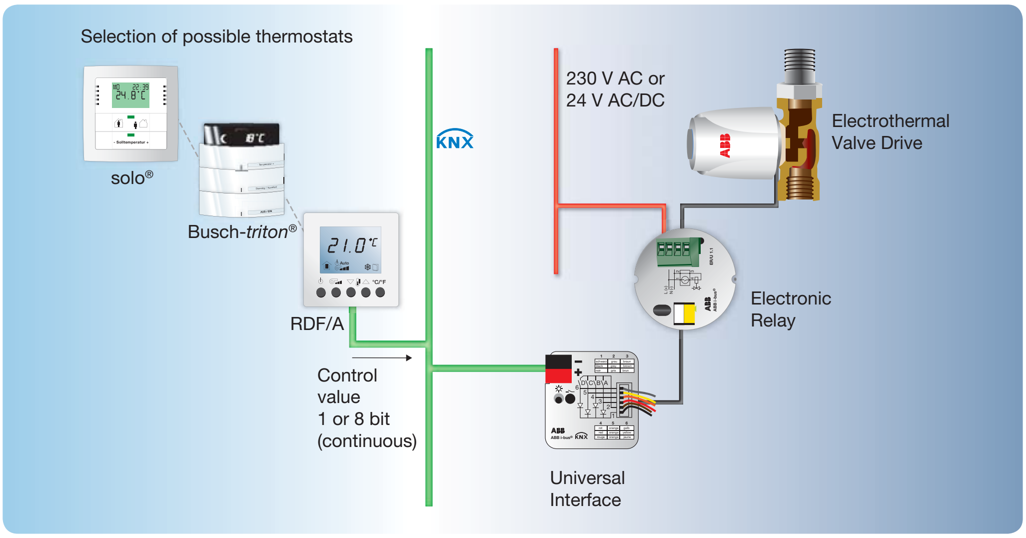

Fig. 13: Room temperature control with electrothermal valve drive, electronic relay and universal interface via KNX

An interesting aspect of this solution is the connection of window contacts to the free channels of the Universal Interface:

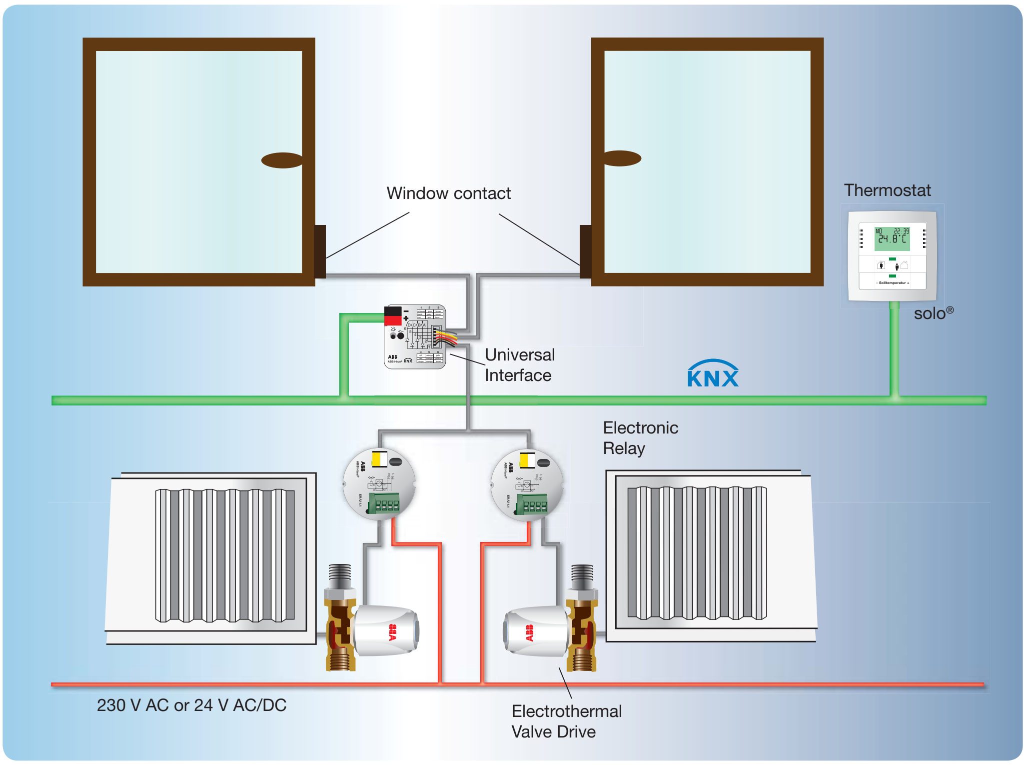

Fig. 14: Solution with connection of window contacts

3.3. Advantages and disadvantages of all actuator solutions

Depending on the application and the project, the different variants shown above are used. **For further information see Heating, Air-Conditioning and Ventilation Control with EIB, chapter 4.2.**

The following chapter provides an overview of the individual solutions for room temperature control using KNX actuators as well as their advantages and disadvantages:

3.3.1. Control with Electromotor Valve Drives

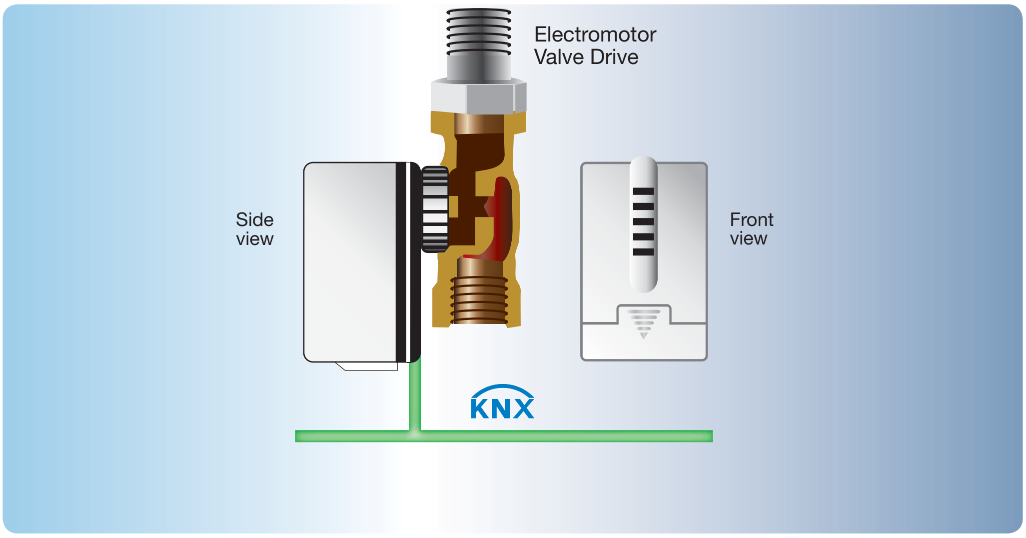

Fig. 15: Electromotor valve drive connected to KNX

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- Simple wiring and connection, just a bus line required to the valve
- Continuous control
- Extra-low voltage

–

- Higher costs
- Motion-related noise (motor with gearing)
- Mechanical wear
- Current consumption 12 mA in motion; this must be carefully monitored with distributed commands and many drives on a line!

3.3.2. Control with Switching Actuators and Electrothermal Valve Drive

Each individual output of a Switching Actuator SA/S can be parameterised with the heating actuator mode.

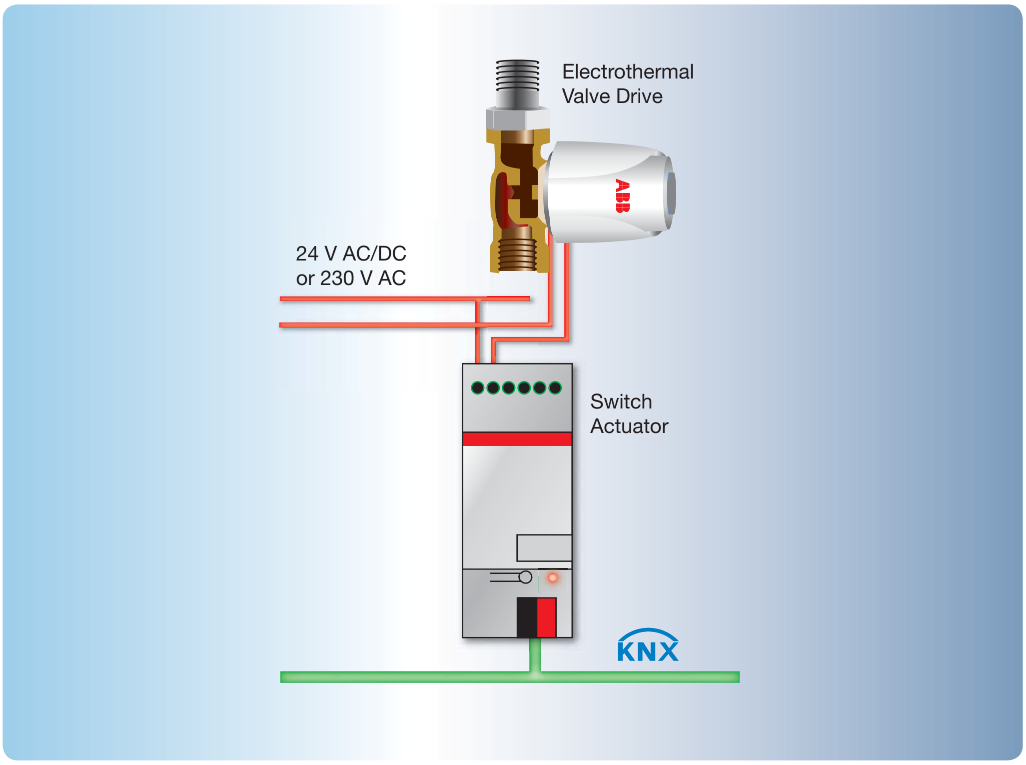

Fig. 16: Electrothermal valve drive connected to KNX via switch actuator

- Attractively priced
- Free switching actuator outputs can be used for other tasks

- Noise (relays)
- Mechanical wear, see product manual SA/S
- Cable routing (valve voltage supply and output)
- Only 2-step or PWM control

3.3.3. Control with Electronic Switching Actuators and Electrothermal Valve Drive

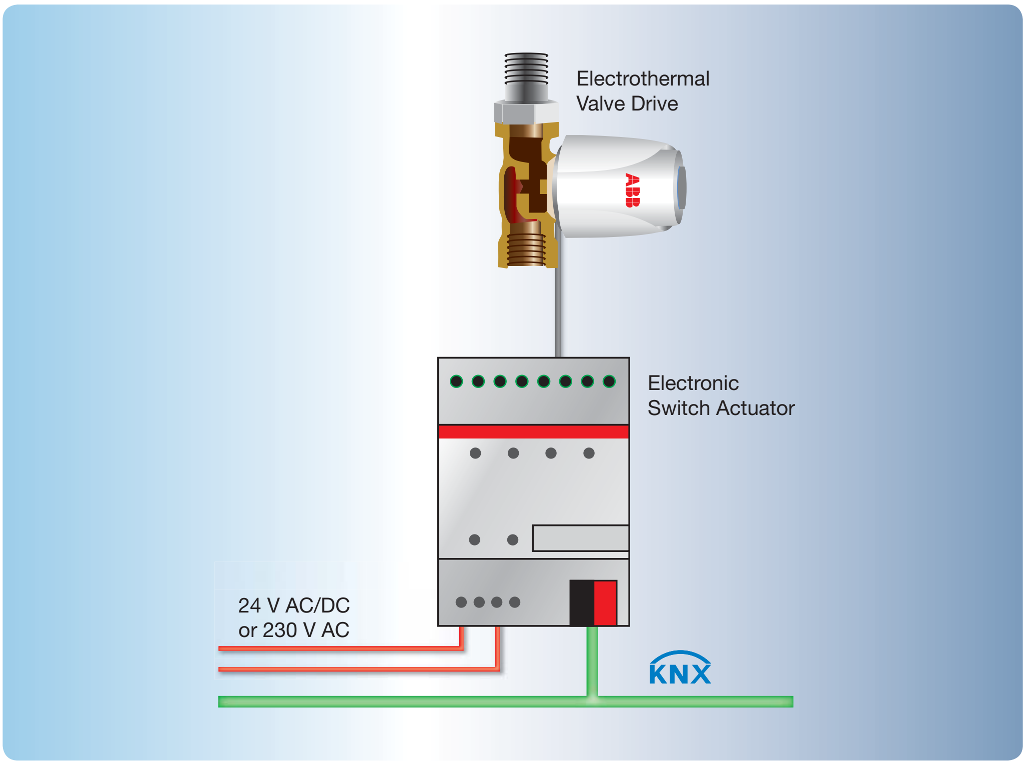

Fig. 17: Electrothermal valve drive connected to KNX via electronic switch actuator

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- Noiseless
- Wear-free

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- Cable routing (valve voltage supply and electronic output)
- Only 2-step or PWM control

3.3.4. Control with US/U x.2, Electronic Relay and Electrothermal Valve Drive

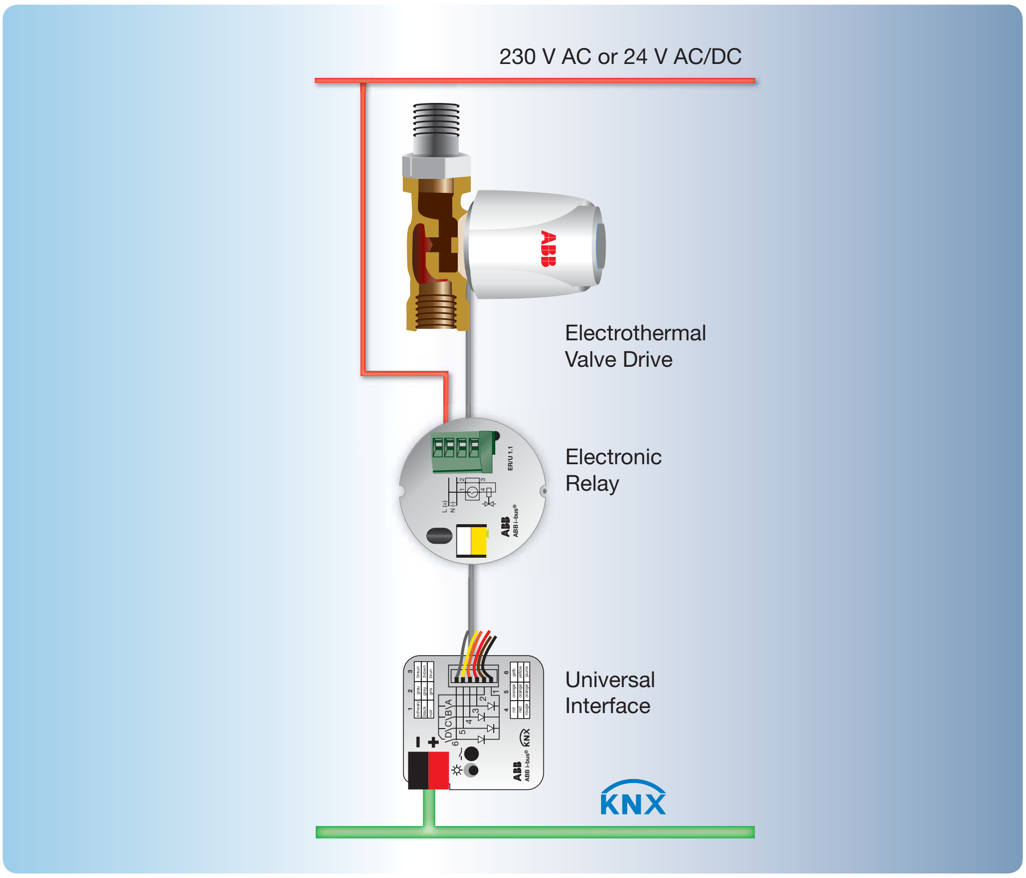

Fig. 18: Electrothermal valve drive connected to KNX via electronic relay and universal interface

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- Noiseless
- Wear-free
- Additional inputs on the US/U, e.g. for window contacts or conventional thermostats

–

- Cable routing, installation (3 devices)
- Only 2-step or PWM control

3.3.5. Control of motor powered valves via 0-10 V control voltage

There are two version options here:

- Proportional thermo-electronic version, e.g. Möhlenhoff AA 5004
- Electromotor version, e.g. Oventrop 1012700

Both solutions can be implemented at the moment with the ABB i-bus® KNX Analogue Actuator AA/S 2.1.

Proportional thermo-electronic version, e.g. Möhlenhoff AA 5004

The valve opens proportionally to the voltage when a control voltage is applied. The valve push rod is moved by heating and the associated expansion of the expansion element.

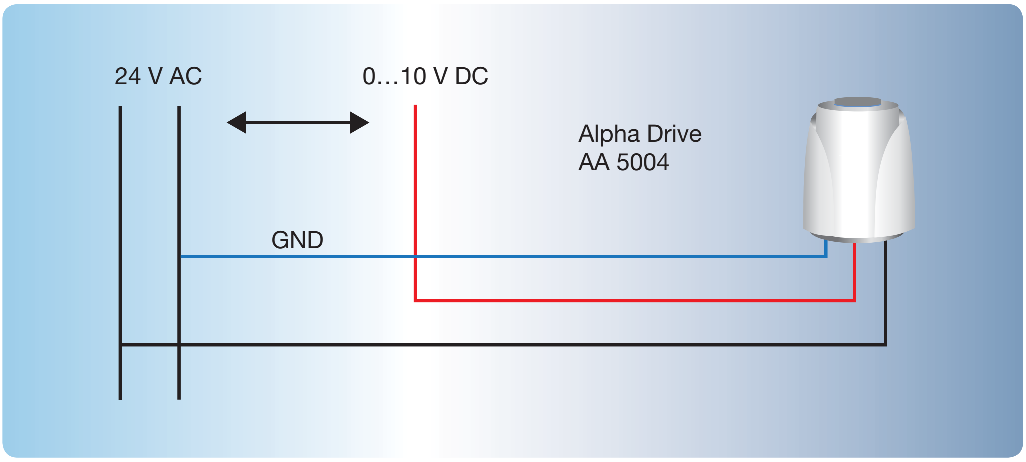


Fig. 19: Function diagram of thermo-electronic valve control with 0-10 V control voltage

Electromotor version, e.g. Oventrop 1012700

The valve opens proportionally to the applied control voltage. The valve push rod is moved by a servomotor.

A fast control reaction is possible by quickly opening and closing the valve.

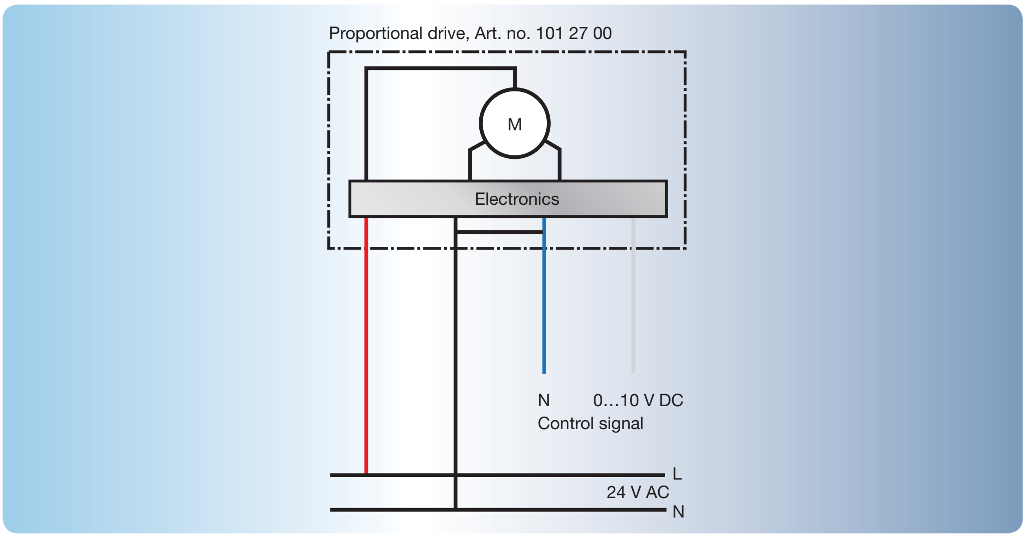


Fig. 20: Function diagram of electromotor valve control with 0-10 V control voltage

3.3.6. Control of motor powered valves via a changeover contact

In principle this solution functions like a motor for blind operation, e.g. Oventrop 1012701.
A changeover contact actuates a motor; the valve is opened or closed depending on the contact position.
A suitable KNX actuator is not currently available for this solution. Even though the hardware of a blind actuator would be suitable, it cannot be used due to incompatibility of the software functionality.

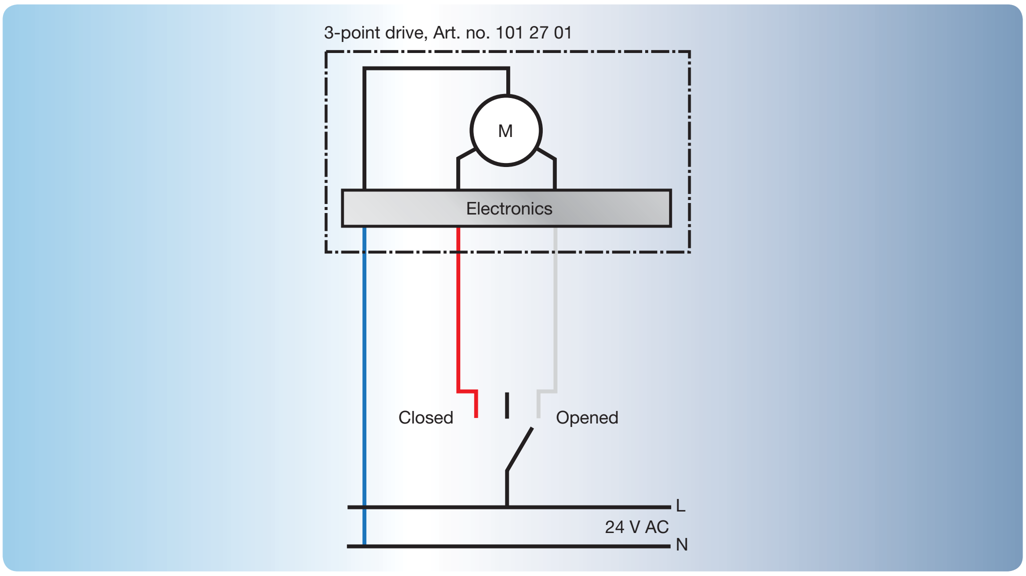


Fig. 21: Function diagram of valve control via changeover contact

3.4. Assignment of the communication objects between a thermostat and a valve actuator

The assignment of the group addresses between the sensor (thermostat) and actuator, e.g. Valve ST/K 1.1, is very simple and explained here using the example of a Busch-*triton*® thermostat and an Electronic Switch Actuator ES/S 4.1.1 driving a thermal valve drive.
The thermostat sends a 1 byte telegram as a control value to Output A of the actuator. This converts this signal to a PWM signal. The basis function of the control is thus fulfilled. When continuous control is selected in Electromotor Valve Drive ST/K 1.1 or with the PWM control, 1 byte communication objects are enabled; and with the selection 2–step control, 1 bit communication objects are enabled.
Other functions, e.g. operating mode switch-over, forced operation, setpoint specification are optional and can be used if required.

1.1.24 ES/S4.1.1 4f-Electron. Switch actuator,0....	0	Output A	6/1/1	Switch-PWM	Living room circuit 1
	1	Output B		Switch-PWM	
	2	Output C		Switch-PWM	
	3	Output D		Switch-PWM	
	4	Output A		Forced position	
	8	Output A		Valve flushing	
	12	Output A		Telegr. Fault	
1.1.25 6326-101 3f-triton-switch with thermostat...	0	Rocker 1		Telegr. switch	
	1	Rocker 2		Telegr. switch	
	2	Rocker 3		Telegr. switch	
	3	Operation mode		comfort mode	
	4	Operation mode		Night mode	
	5	Operation mode		Frost/heat protection	
	7	Control value	6/1/1	Heat (continous)	Living room circuit 1
	9	Base setpoint		Telegr. temperature	
	10	Current temperature		Room temperature	

Fig. 22: Assignment of the sensor – actuator group address with room temperature control

4. Blower convectors (Fan Coil Units)

Blower convectors are heat exchangers where the flow of water is controlled by a valve just as in radiators and underfloor heating. Warm or cold air is blown into the room generally using a 3-speed fan. This forced convection allows the room to heat up or cool down quickly. There are systems for heating and/or cooling with 2, 3 or 4 conductors or water pipes (2/3/4 pipe systems).

For further information see Fan Coil Actuator FCA/S 1.1M product manual

Principle schematic of a blower convector unit (4 pipe system):

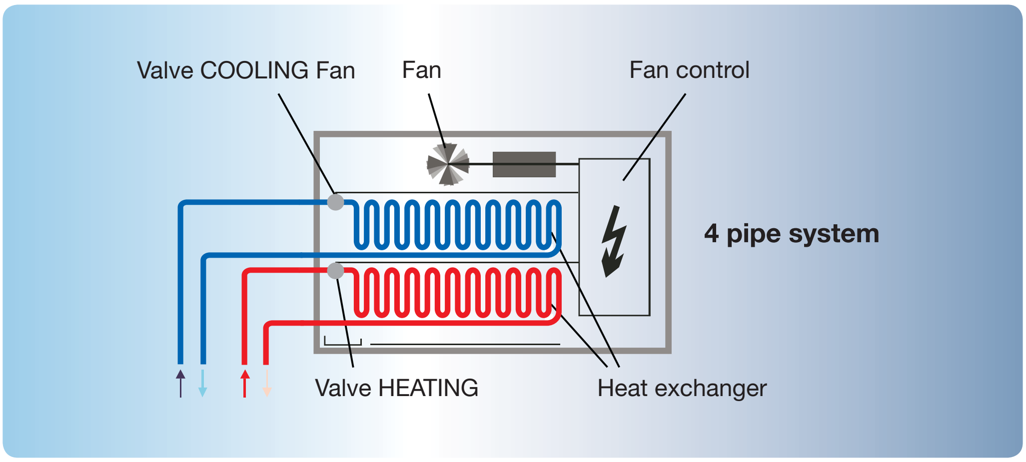


Fig. 23: Principle schematic 4 pipe system

If a 3-speed fan is assumed, 3 switch outputs are required for the fan and one output each for the HEATING or COOLING valve. Depending on the number of valves (1 or 2), 4 or 5 switch outputs are required.
In the following three possible versions are shown:

Version 1

Use of ABB i-bus® KNX Fan/Fan Coil Actuators with relay outputs:
LFA/S 1.1 with four outputs (1 x valve, 3 x fan) or
LFA/S 2.1 with eight outputs (1 x valve, 3 x fan) and four other outputs. These can be used for an additional valve, up to five fan speeds or as a normal switching output.

Version 2

Use of the ABB i-bus® KNX Fan Coil Actuator:
FCA/S 1.1M with two electronic outputs for HEATING and COOLING valves, three relays for three fan speeds, one further switch output and two binary inputs.

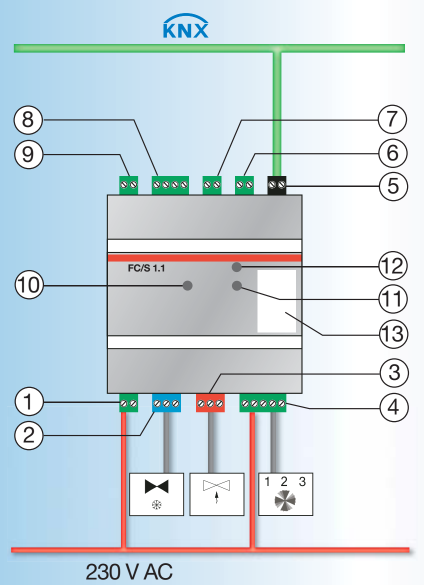
Blower convectors (Fan Coil Units)

Differences between LFA/S x.1 and FCA/S 1.1M

FCA/S 1.1M	LFA/S x.1
Binary Input	–
Add. Output 16 A (AC1) 10 A (AX)	Up to 4 add. Outputs 6 A (LFA/S 2.1)
–	Output progr. for Valve Control
Electronic Output for Valve	Replay Output for Valve
Raise/Lower Valves	–
Electrothermal Valves	–
–	Electrothermal Valves
Fan Limitation (plus Forced Operation for Valve)	Fan- and Valve Limitation
1, 2 or 3 Fan Stages	3 or 5 Fan Stages
Manual Operation	–
Valve Curve Adaption	–
Commissioning with NTI/Z 28.30.1	–

Version 3

Use of the ABB i-bus® KNX Fan Coil Controller FC/S 1.1 with integrated controller:



Connections

1	230 V AC power supply
2	Cooling valve
3	Heating valve
4	Fan (up to 3 speeds)
5	KNX
6 + 7	Two binary inputs 24 V AC
8	Temperature sensor + potentiometer
9	24 V AC auxiliary voltage for binary inputs
10	Test push button
11	Programming push button
12	Programming LED/Test LED
13	Test table

Fig. 24: Room temperature control with blower convectors using FC/S 1.1

On versions 1 and 2, an additional thermostat is required; on version 3, the FC/S 1.1 can operate as a stand-alone device. The device features the full functionality of a thermostat. The setpoint can be specified in the parameters or changed manually via a potentiometer that is connected separately. The room temperature value is detected via a temperature sensor installed on the FC/S.

Blower convectors (Fan Coil Units)

Fan Coil Controller FC/S 1.1 with Busch-*triton*®

There is frequently a requirement to combine the FC/S 1.1 with room temperature controllers from the Busch-*triton*® range, e.g. to implement control of the lighting or blinds in addition to room temperature control.

> **+** All room functions can be operated from a single device.

Both the push button as well as the Fan Coil Controller FC/S 1.1 are thermostats, and only one device can assume the control function in conjunction with both components. As the thermostat cannot be switched off on the FC/S 1.1, the “intelligence” of the push button must be suppressed, i.e., the push button with the thermostat only detects the room temperature and sends the value to the FC/S 1.1. Additionally, the status of the setpoint from the push button is sent to the FC/S 1.1. If the setpoint is changed manually on the push button, or if it receives another external setpoint, the FC/S receives the correct value via KNX.

In principle, the operation and function is guaranteed with this solution. However, some points must still be observed to ensure smooth operation:

1. In the thermostat and FC/S 1.1 all temperature values (basis setpoint, reduction or increase, Standby and Economy operation, insensitive zone between HEATING and COOLING, Heat protection or Building protection setpoint) are to be set to the same values.

2. The switch-over to the Comfort, Standby and Economy modes should always be carried out via the thermostat push button, i.e. the thermostat push button determines the operating mode. The reason for this is that the symbols on the thermostat display are directly linked to the operating mode. This prevents the controlling FC/S 1.1 from being in a different mode than the mode indicated on the display.

3. The situation with bus voltage failure and recovery (thermostat) and supply voltage failure and recovery (FC/S) is always important. For this reason, the thermostat parameter *Operation mode* after reset and the FC/S parameter *Controller status at power on* should be parameterised to the same value.

4. The parameterised basis setpoints in the thermostat push button and in the FC/S 1.1 are stored in the EEPROM memory. These values are not lost should the supply voltage fail. Should an external setpoint value occur, e.g. the thermostat push button sends a new setpoint to the FC/S (temperature increase from 21 °C to 23 °C), it will be stored in the Flash memory of both devices. These values are lost if the bus voltage fails. Should just the supply voltage fail (bus voltage OK!) on the FC/S, only it will lose its present value and return to the basis value (21 °C), whereas the thermostat switch still retains its value of 23 °C. After the cycle time set in the thermostat push button for automatic sending, the actual temperature and the current setpoint (adjustable between 3 and 60 min) of both components will be resynchronized.

Accordingly, the thermostat push button also loses its current setpoint with bus voltage failure.

5. The used control functions with the thermostat are either HEATING or HEATING and COOLING. These are active depending on the room temperature and setpoint. Only COOLING alone cannot be set on the thermostat; however, it can be parameterized with the FC/S 1.1. Under certain circumstances this can lead to an incorrect display on the thermostat.

   Only COOLING is necessary in a building and is realized with KNX via the thermostat push button and FC/S 1.1. In winter, the actual value in the room drops below the setpoint, which means as far as the thermostat is concerned that heating is required. The HEATING symbol is shown on the display. As there is no heating and no group address assignment of the KNX devices, the function is not performed.

6. At bus voltage recovery, the thermostat push button initially goes to HEATING mode; the HEATING symbol is visible. Seconds later, after the comparison between actual and setpoint values, the respective operating mode is set, e.g. COOLING, and the symbol is updated accordingly.

This description relates to the use of the thermostat push button Busch-*triton*®. Should other KNX push buttons with thermostat function and divergent parameters or conventional push buttons be used, the respective push button options for parameterization and assignment must be considered and adjusted accordingly.
The thermostat solo® TUS/U 1.3 and 2.3 as well as the Room Thermostat Fan Coil with Display are more flexible. It is possible to parameterize that the device does not use a thermostat function and only operates as a display and operating device, and that it measures the room temperature if required.

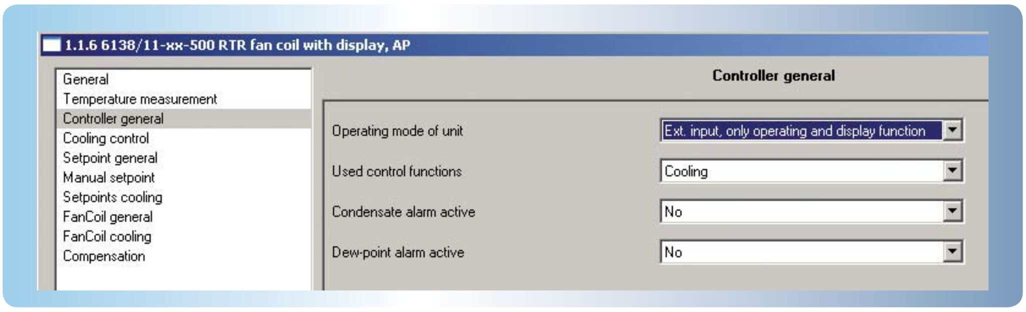


Fig. 25: Parameterization of room temperature measurement as an extension

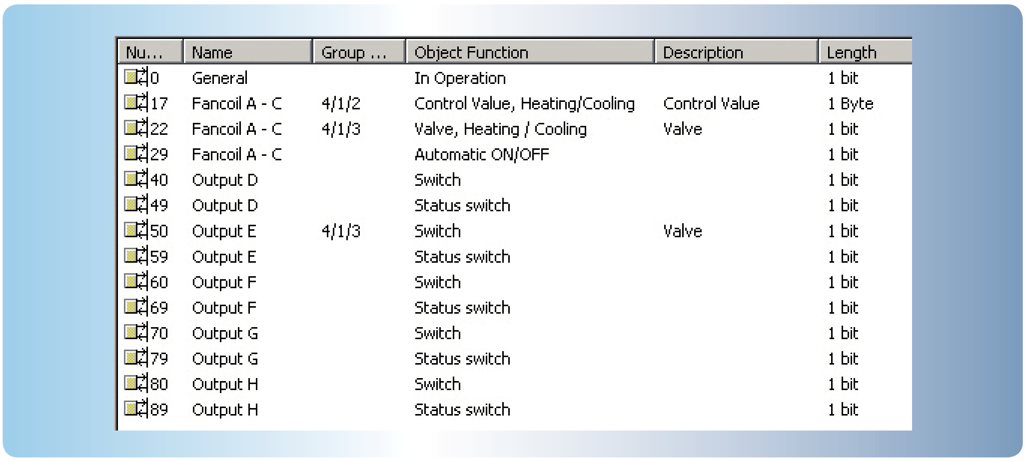
4.1. Assignment of the communication objects between a thermostat and a fan coil actuator (particularly the LFA/S 1.1 and 2.1)

The assignment is in principle identical with the connection to a valve or fan described in chapter 3.4. However, the FCA/S always has a 1 byte communication object Control value available to it.

Due to the flexibility of the device, a distinctive feature must be observed with the LFA/S 1.1 or 2.1. The 1 byte control value originates in the usual way from the thermostat. Additionally, an internal connection must be established between the communication object Valve and the switch output, on which the electrothermal valve drive is installed. In this example, group address 4/1/3 is used.

With the LFA/S 1.1, Output D is available; with the LFA/S 2.1, Outputs D…H are available.

! In the parameters of the valve output (Output E in this case), the operating mode *Switch actuator* should be set.



Nu…	Name	Group …	Object Function	Description	Length
0	General		In Operation		1 bit
17	Fancoil A - C	4/1/2	Control Value, Heating/Cooling	Control Value	1 Byte
22	Fancoil A - C	4/1/3	Valve, Heating / Cooling	Valve	1 bit
29	Fancoil A - C		Automatic ON/OFF		1 bit
40	Output D		Switch		1 bit
49	Output D		Status switch		1 bit
50	Output E	4/1/3	Switch	Valve	1 bit
59	Output E		Status switch		1 bit
60	Output F		Switch		1 bit
69	Output F		Status switch		1 bit
70	Output G		Switch		1 bit
79	Output G		Status switch		1 bit
80	Output H		Switch		1 bit
89	Output H		Status switch		1 bit

Fig. 26: Internal valve output connection with the LFA/S 2.1

5. Ventilation

The objective of room and building ventilation is to influence the temperature or air humidity, remove bad odours or smoke or to reduce the concentration of CO_2 in the air. Generally the ventilation exchanges the internal air with external air, but also by circulation of the air within the building.
A differentiation is made between natural ventilation and forced ventilation.

5.1. Natural ventilation

During natural ventilation, the air is exchanged without the use of mechanical systems, e.g. a ventilator driven by a motor. The simplest form of natural ventilation is manual opening of a window in the room.
Instead of manually opening the window, it is also possible to employ motor-operated windows.
They can be operated via the ABB i-bus® KNX shutter actuators.

For further information see application manual shutter control

5.2. Mechanical ventilation

Air is exchanged with mechanical ventilation using a fan. A typical example is a ventilator in a bathroom. A further solution entails the use of ceiling fans to circulate the air in the room. An additional reason for the use of these devices is better distribution of the heat in the rooms. With fan and blower control via KNX, it is not just necessary to switch the systems on and off, but to also change the speed.

A differentiation is made between continuous and step speed control:

5.2.1. Continuous speed control

A fan motor can change the speed using a control unit such as a frequency inverter.
A corresponding signal, e.g. 0…10 V, is provided by a KNX Analogue Actuator, e.g. AA/S 4.1.

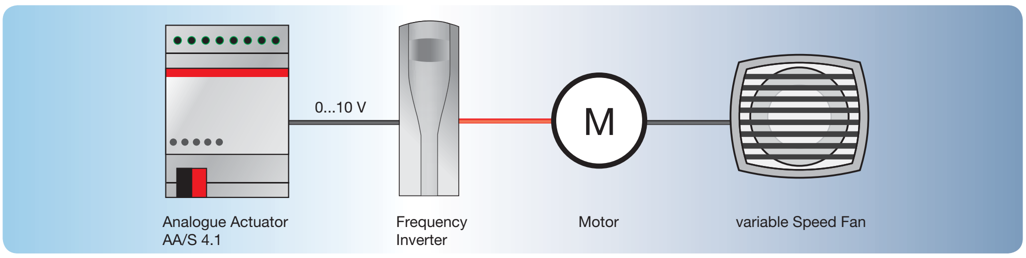


Fig. 27: Analogue Actuator AA/S 4.1 with fan speed control via a frequency inverter

5.2.2. Step speed control

A step control of the motor is used frequently. The drive can be operated at several speed steps. Relay contacts are required for this purpose and are used to control different motor windings. KNX requires a multi-channel switching actuator with the corresponding software, which is available for the Fan/Fan Coil Actuators LFA/S x.1.

- LFA/S 1.1 with three fan speeds
- LFA/S 2.1 with up to five fan speeds or two independent fans with three speeds

A differentiation is made between automatic and manual operation:

Automatic operation

The speed is changed depending on the control value, e.g. representing temperature or air humidity. The thresholds with hysteresis for changing the fan speed are adjustable in the actuator.

Further software parameters:

- Switch on response, i.e. which speed is used to start
- Dwell time at a speed
- Fan limitation

Manual operation

An important factor with a fan control is the option of manually adjusting the speed, e.g. with a button. The Blower Convectors LFA/S x.1 offer three options:

- **1 bit UP/DOWN:** The value 1 increases the speed, the value 0 reduces the speed. This is easy to implement with two sides of a KNX push button.
- **1 bit direct**: A communication object is available for each speed. This enables jumping to a speed directly via individual buttons.
- **8 bit value:** A speed is activated with a Fig. value of an 8 bit telegram.
  Example for 3 speeds:
  0: OFF
  1: Speed 1
  2: Speed 2
  3: Speed 3

Ventilation

When switching from one speed step to another, the type of motor control must be observed. A differentiation is made between a step and changeover switch:

Step switch

Speed 1: Relay 1 is connected.

Speed 2: Relay 2 is connected additionally.

Speed 3: Relay 3 is connected additionally, i.e., all three relays are closed at speed 3.

Changeover switch

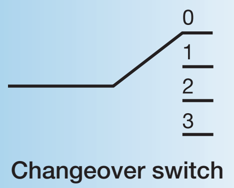
Speed 1: Relay 1 is connected.

Speed 2: Relay 1 is opened, then relay 2 is closed.

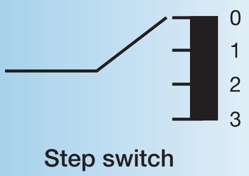
Speed 3: Relay 2 is opened, then relay 3 is closed.

The time between switch-over of the relays is adjustable.

The following diagram illustrates the differences:



	Output A	Output B	Output C
OFF	0	0	0
Speed 1	1	0	0
Speed 2	0	1	0
Speed 3	0	0	1



	Output A	Output B	Output C
OFF	0	0	0
Speed 1	1	0	0
Speed 2	1	1	0
Speed 3	1	1	1

Fig. 28: Comparison of changeover and step switch

✱ The standard parameter configuration setting is the changeover switch. This should only be changed when required and when sufficient knowledge concerning the motor control is available.

! Motors requiring a changeover switch configuration may not be operated in a step switch configuration. Otherwise the motor will be destroyed!

6. Control functions

Different control functions are available to operate the heating, ventilation and air-conditioning of a building to ensure the greatest possible level of comfort:

- Timer control
- Occupancy control

6.1. Timer control

It is useful to combine individual room control with timer control in the interest of energy conservation and comfort.

In a dwelling, the bathroom should be 22 °C between 6 and 7 in the morning and 10 and 11 at night, and 18 °C at all other times. The temperature in the dwelling should also be 22 °C between 5 in the evening and 11 at night. During the day, a temperature of 19 °C is sufficient.
In a school, the temperature should be 21 °C between 7:30 in the morning and 2 in the afternoon. At other times 16 °C is sufficient.

A temperature control process is slow to react. It is therefore useful to commence the reduction in temperature as early as possible to utilize the existing heat. It also makes sense to commence raising the temperature before the desired time to ensure that the room is warm at the appointed time.

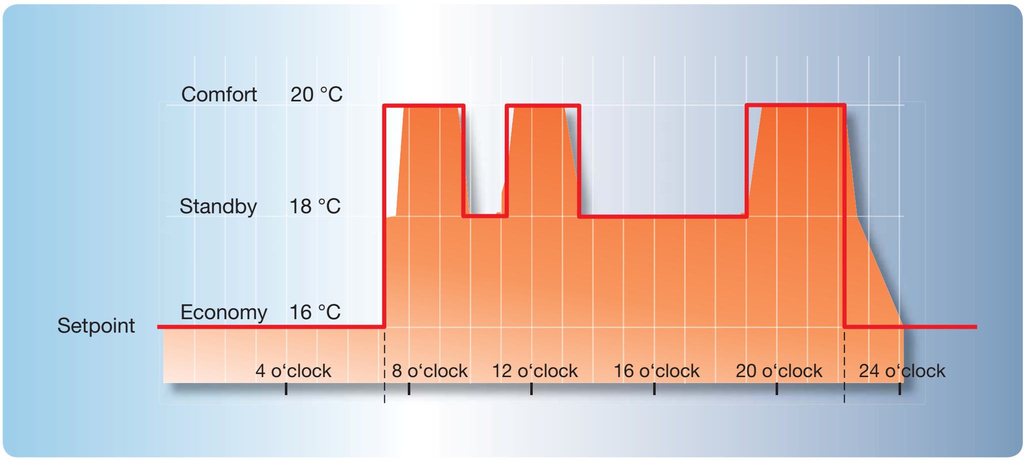


Fig. 29: Example for timer controlled heating with 3 different temperatures

All the forms possible at the current time for implementing timer control with KNX as well as a presentation of suitable devices are described in the Lighting application manual, chapter 3.4.

Control functions

Here you can see an overview of available KNX devices:

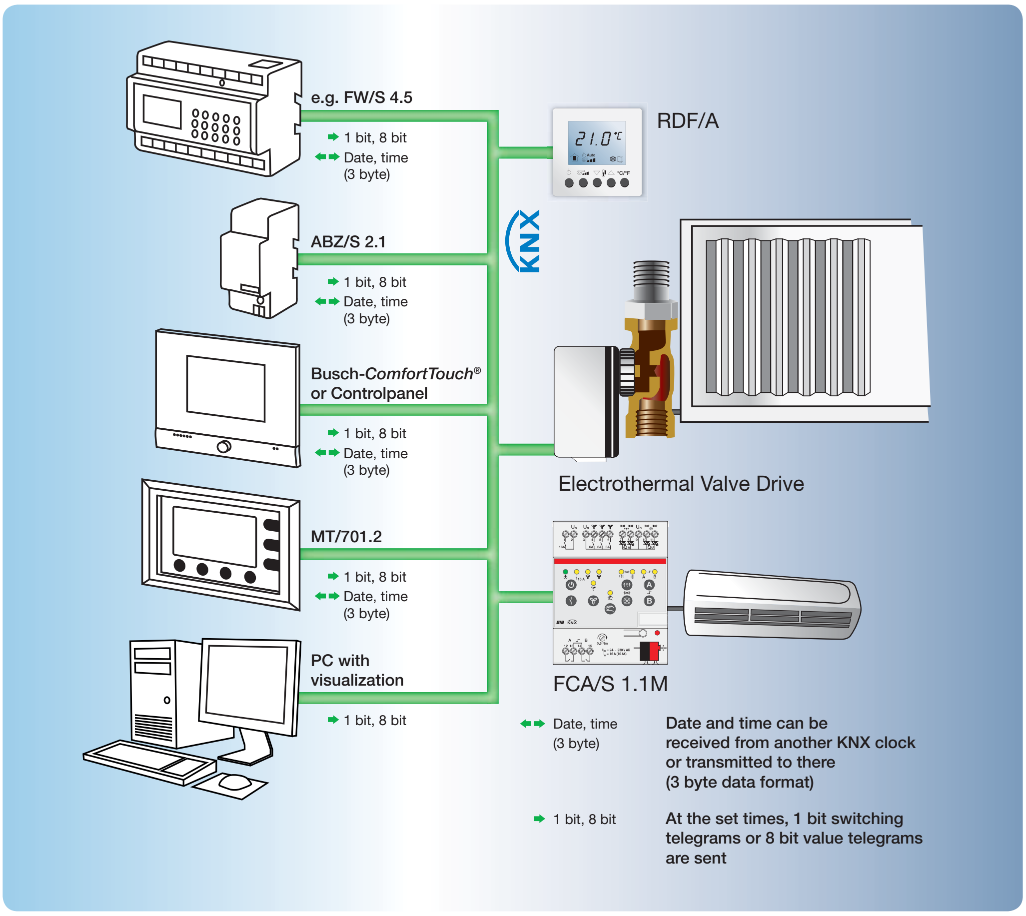


Fig. 30: Device overview for timer control in conjunction with room temperature control

6.1.1. How do you change the setpoint with room temperature control?

The setpoint is specified in the thermostat. A new basis setpoint can be sent to the device at any time in 2 byte floating point value data format.

5	Base setpoint	4/3/10	Telegr. temperature	2 Byte	C	R	W	-	-	Low
6	Current temperature	4/3/11	Room temperature	2 Byte	C	R	-	T	-	Low
7	Current setpoint	4/3/12	Telegr. temperature	2 Byte	C	-	-	T	-	Low

Fig. 31: Setpoint assignment in the thermostat

Implementation with Application Unit ABZ/S 2.1

The Application Unit ABZ/S 2.1 with application Times/Quantities provides this option. The time controlled telegrams (800 switching times are possible!) can be 2 byte floating point types here.

Control functions

First of all a timer program is parameterised containing daily and weekly schedules and may include special days, which send 1 bit telegrams (0 or 1) at certain times.

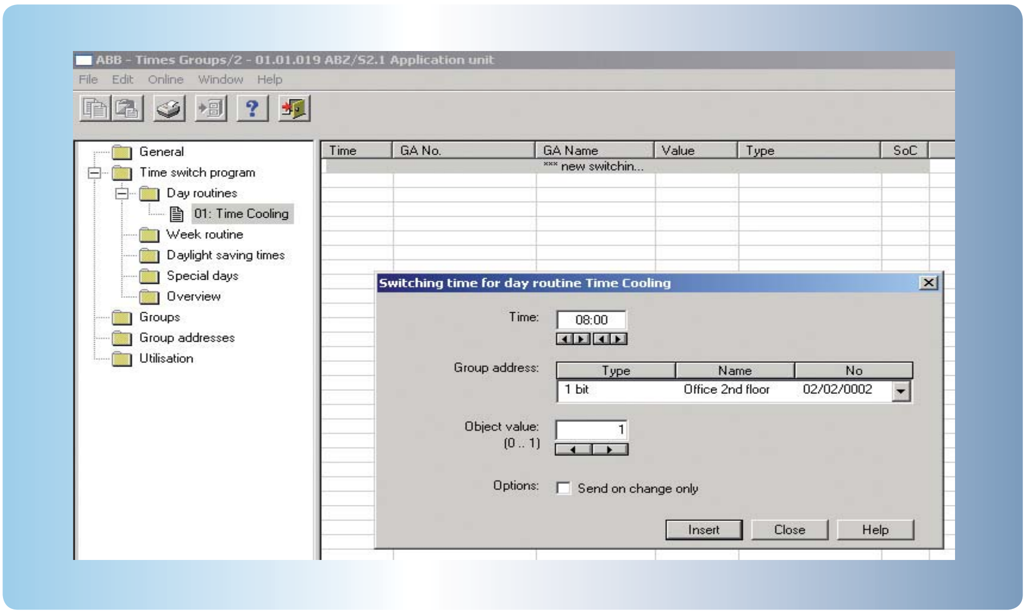


Fig. 32: Setpoint assignment via ABL/S 2.1 with application Times/Quantities/2

A group is then activated, 1 bit type:

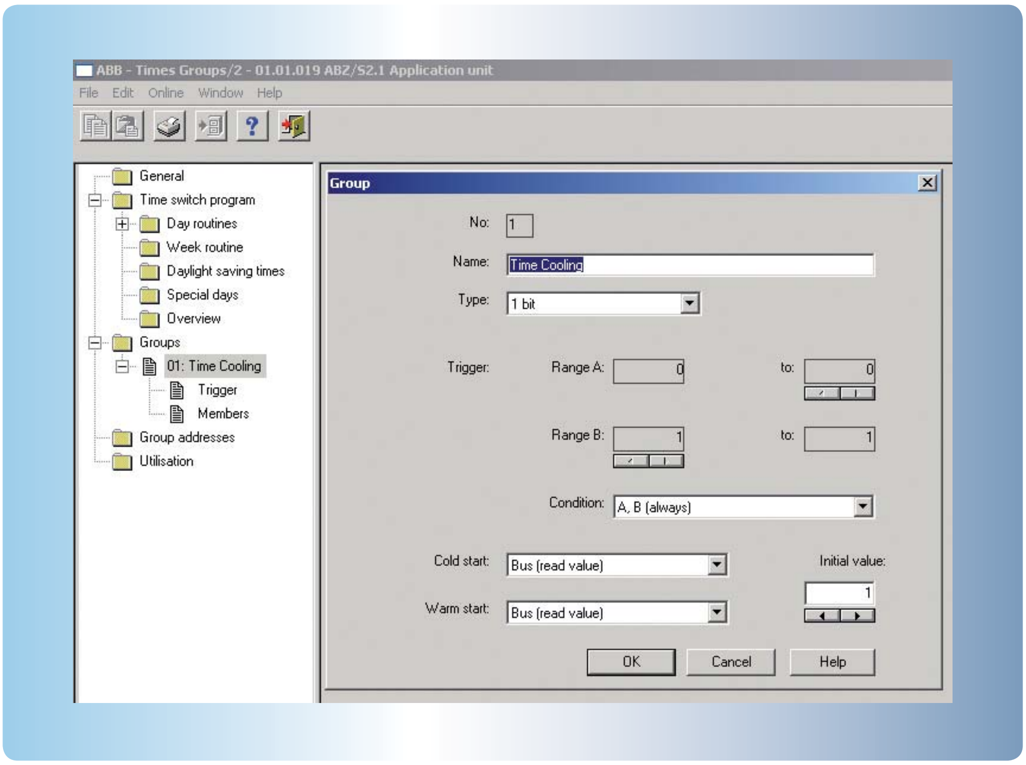


Fig. 33: Setpoint assignment via ABL/S 2.1 – Quantity activation

The Trigger group address is the address sent by the function time:

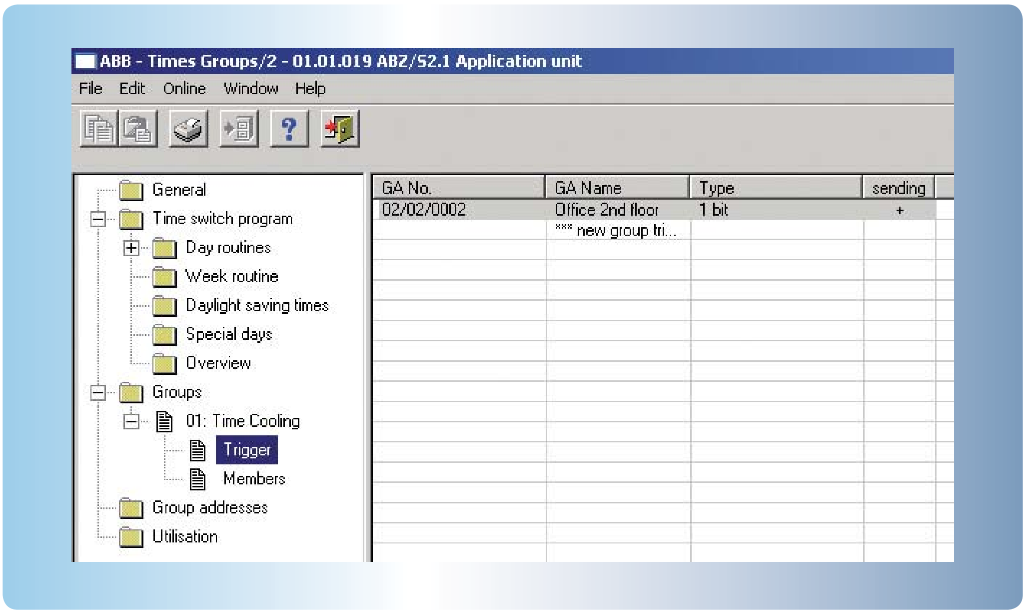


Fig. 34: Setpoint assignment via ABL/S 2.1 – Trigger group address

The group member is the new setpoint in the 2 byte floating point format. The group can contain several members, in this case different setpoint values:

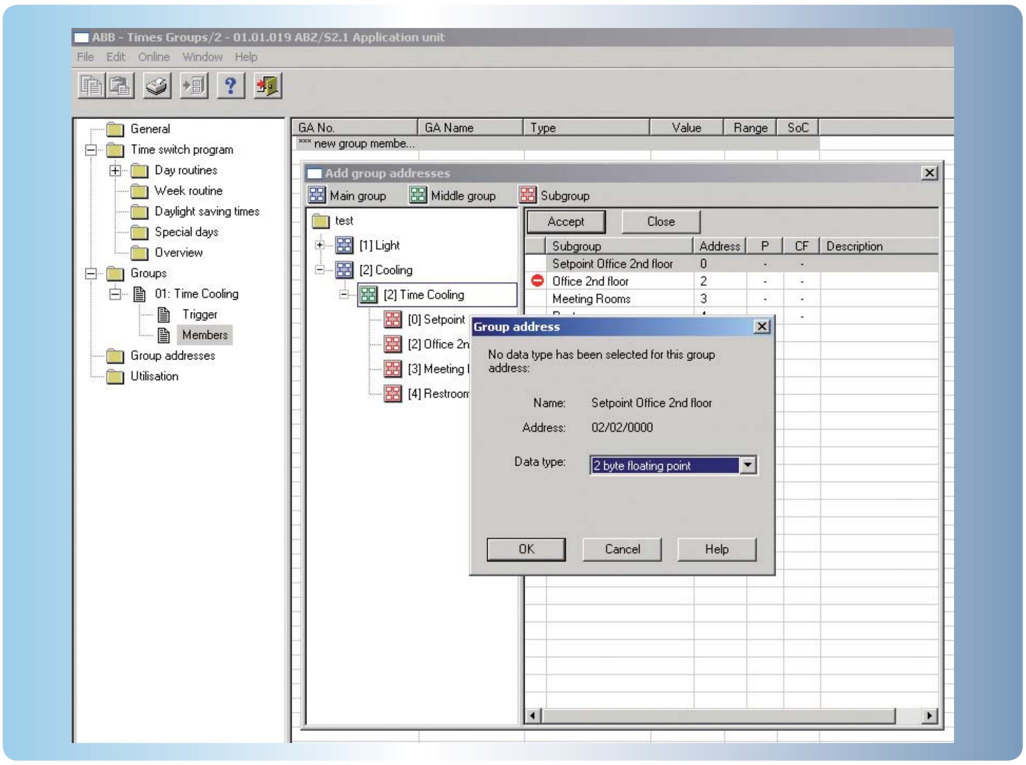


Fig. 35: Setpoint assignment via ABL/S 2.1 – Format selection

If the value 1 is sent by the timer program, *Send value on trigger* in range B is set; with the value 0 range A is set:

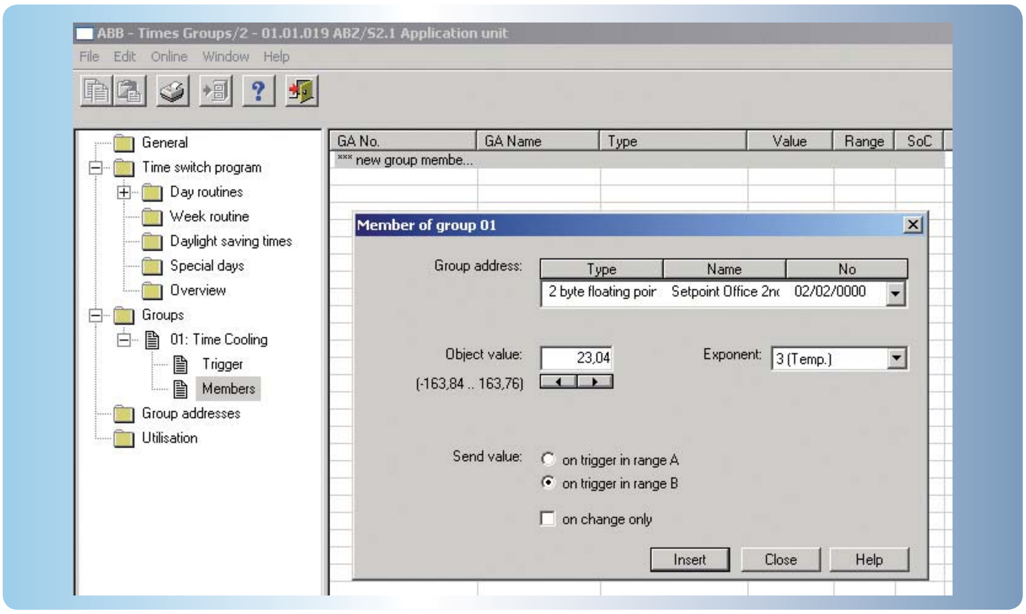


Fig. 36: Setpoint assignment via ABL/S 2.1 – Area A or B member assignment

> **✱** The panels with touch display Busch *ComfortTouch*® and Controlpanel as well as a visualisation software are also capable of changing setpoints.

Realization through the thermostat operating modes

A further possibility to change the setpoints is to use the four operating modes of the room temperature control. The available modes are Comfort, Standby, Economy and Building protection.

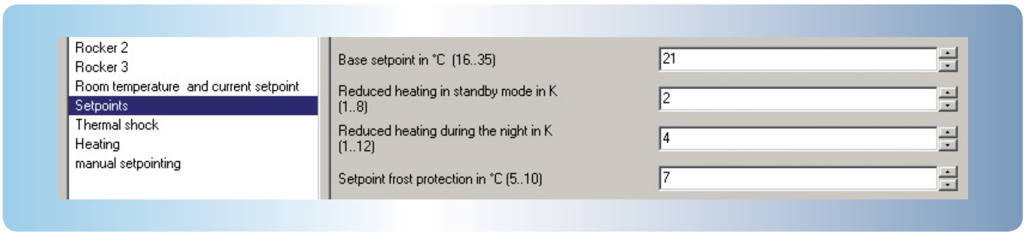


Fig. 37: Setpoint assignment via thermostat modes

Control functions

In the thermostat parameters, an individual temperature can be specified for each operating mode.

The switch-over to the respective operating mode can be realized via 1 bit communication objects. Every device with function time can do this.

3	Operation mode	comfort mode	1 bit
4	Operation mode	Night mode	1 bit
5	Operation mode	Frost/heat protection	1 bit

Fig. 38: Setpoint assignment via thermostat modes – group addresses

With just three communication objects it is possible to switch between four modes.
The way, in which this functions, can be found in the technical data of the thermostat.

Here is an extract from the technical data of the 3-fold push button Busch-*triton*® with integrated thermostat:
“The thermostat has four operating modes. The frost protection mode has the highest priority i.e. if this mode is active, it is not possible to switch to another mode. The frost protection mode must be deactivated again first e.g. by closing an open window. The comfort mode has the next highest priority followed by night operation. If none of these three modes is active, the thermostat is set to standby mode (see also the diagram of the operating modes on the next page).”

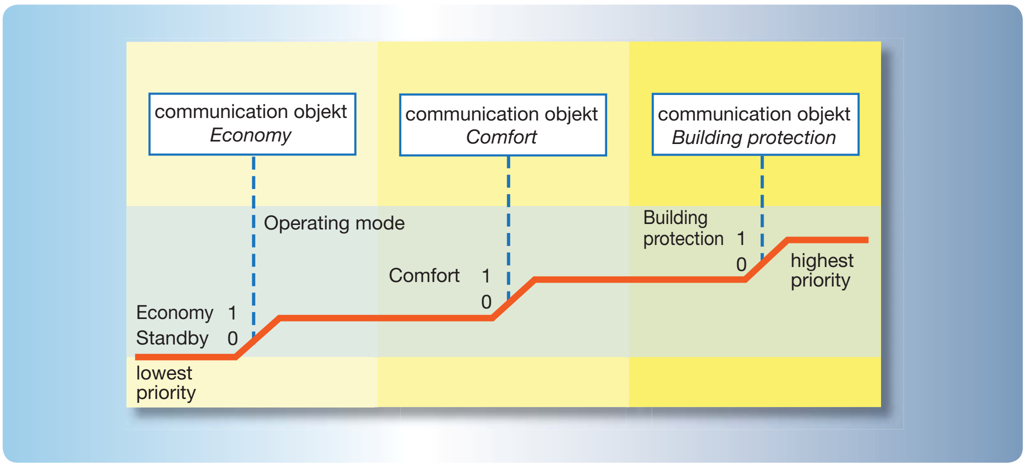


Fig. 39: Mode selection via three communication objects

In day-to-day use, the communication object *Comfort* is used frequently, the value 0 switches to Economy mode, the value 1 switches back to Comfort mode. If Economy mode is active, the communication object *Night* switches to Standby mode using the value 0. Now the communication object *Comfort* can be used to switch between Comfort mode (value 1) and Standby mode (value 0).
A decision relating to the switch-over method must be taken with respect to the project and product.

Realization with the Room Thermostat Fan Coil with Display RDF/A 1.1

With the Room Thermostat Fan Coil with Display RDF/A 1.1 as well as the thermostat solo® TUS/U 1.3 and 2.3, there is an additional possibility to switch directly between all operating modes via 2 x 1 byte communication objects. Here is an extract from the RDF/A 1.1 product manual:

“Operating mode switchover

Options: – 1 Bit (3 x DPT_Switch)
– **1 Byte (2 x DPT_HVACmode)**

Switching operating mode defines whether the ambient temperature controller has three 1-bit communication objects, *Comfort/Standby*, *Night Mode* or *Freezing/Heat Protection*, or two 1-byte communication objects for switching operating mode.

If an ON message is received by the Comfort/Standby object in 1-bit switching operating mode, the Comfort operating mode is activated.

If an OFF message is received Standby mode is activated. If an ON message is received by the Night Mode object, night operating mode is activated. An OFF message deactivates Night Mode.
Freezing/Heat Protection mode is also activated with an ON message and deactivated with an OFF message. If an ON message is received by multiple objects, Freezing/Heat Protection has a higher priority than Comfort Mode. Night reduction has a higher priority than Comfort Mode.

When switching operating mode via 1 byte two 1-byte communication objects are available. Note: the two 1-byte communication objects have different behaviour when receiving a message. One object evaluates received messages „normally“. This means, for example, if a comfort telegram is received, the room thermostat switches to comfort mode.
If a night telegram is received, the ambient temperature controller switches to night mode. This object is controlled, for example, by time switches. The second object can „overwrite“ the first object temporarily. This means, for example, if a Freezing/Heat Protection telegram is received, the ambient temperature controller switches to Freezing or Heat Protection mode. If freezing or heat protection is reset by another message, the ambient temperature controller activates the operating mode pending at the „normal“ object. As a result, it is capable of noting operating modes.

The following applies to the 1-byte communication object:
0 = Auto
1 = Comfort
2 = Standby
3 = Night
4 = Freezing/Heat Protection
5 – 255 = not allowed”

The option for the 1 byte communication objects allows the greatest possible level of flexibility, as now direct switch-over from one mode to another is possible. The prerequisite is the availability of the 1 byte communication object, which is generally the case with the available KNX sensors.

6.2. Occupancy control

In addition to the timer control described in chapter 3.1, it is very often useful to change the setpoints as a function that is dependent on the presence of persons, in order to save energy.

6.2.1. Which devices detect the presence of persons?

Motion and presence detectors detect occupancy.
Presence detectors have the advantage that they detect the presence of persons, who are seated. They are therefore especially suited to offices and schools, where there is not a lot of movement or where the rooms are empty during breaks.

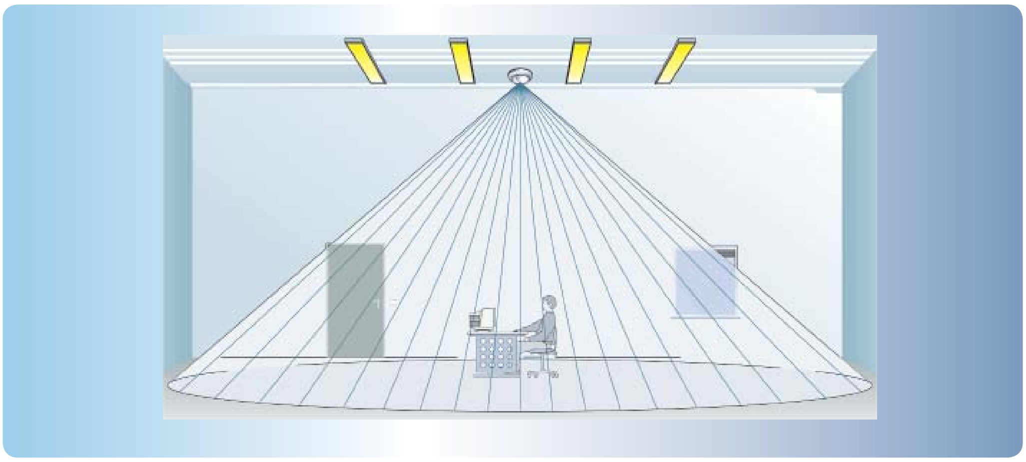


Fig. 40: Presence detector in an office

A more detailed description of the detectors can be found in the Lighting application manual, chapter 3.5.

Control functions

Here you can see an overview of available KNX devices:

alpha *nea*®

solo®

Fig. 41: Motion detectors for indoor use

Fig. 42: Motion detectors for outdoor use

Fig. 43: Presence detector

Outdoor motion detectors are definitely not intended for temperature control. One possible area of application, e.g. a production hall that is never heated or only heated to a low standby level, where a higher temperature setpoint is only initiated when persons enter the hall at the start of work.

> Observe the speed of the heating and cooling times. It is not useful to allow a room to cool down during a break should the room only cool down, for example, at a rate of one degree per hour. The heating up phase here will take correspondingly longer, so that the temperature that is set is offset to the actual requirement profile.

When cooling or heating with blower convectors (Fan Coil Units), the temperature setting is achieved quicker than with pure convection heating. The use of presence detectors for temperature control is suitable here.

Delay times can be programmed in presence detectors to ensure that a reduction does not occur with short interruptions.

Control functions

The useful application of presence-dependent control in a building depends on the following criteria:

- The time constant for heating up and cooling down the rooms
- Thermal insulation
- Heat storage capacity of the walls
- Method of heating and cooling (slow <-> fast)
- Type and duration of the interruption in usage

In practice, check whether this type of temperature control is useful and possible.

Presence and motion detectors are generally not used exclusively for this purpose; they are used for lighting control either.

A further possibility for room control is the combination of occupancy control with timer control. The following two graphics show the progress of the setpoint over time using the example of a heating and cooling application.

HEATING:

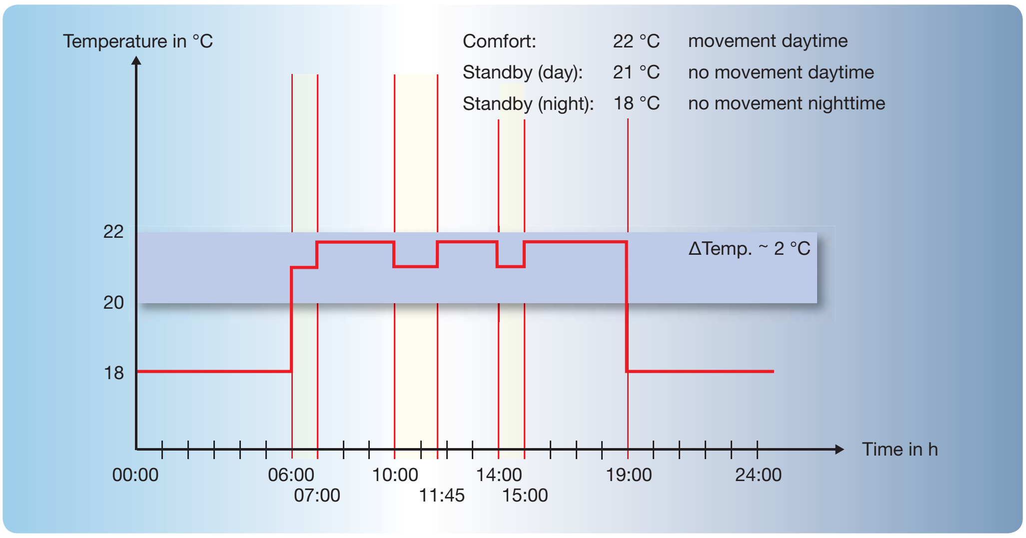


Fig. 44: Progression of HEATING setpoint over time

COOLING:

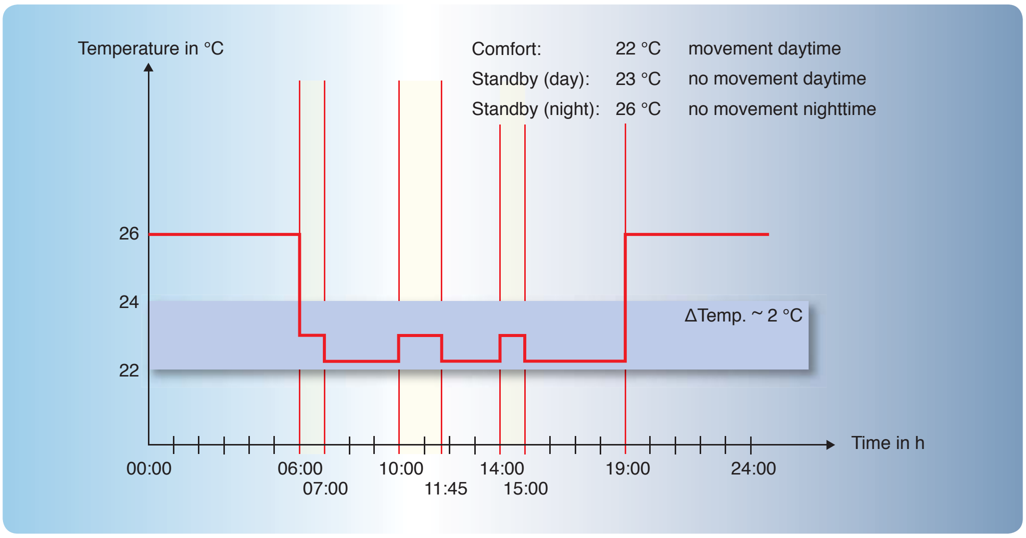


Fig. 45: Progression of the COOLING setpoint over time

7. Special functions

Various special functions are available to operate the heating, ventilation and air-conditioning of a building as comfortably as possible:

- Temperature detection with blower convectors and temperature detection independent of KNX thermostats
- Temperature control with window contacts
- Additional HEATING/COOLING stages
- Communication between electromotor valve drives
- Maintenance of blower convector filters
- Valve purging

7.1. Temperature control with fan coil units and temperature detection independent of KNX thermostats

Generally the room temperature is measured with KNX individual room temperature control using a room temperature sensor. Accordingly, a spatial distance usually occurs between the heat and cold source, which has an influence on the control operation (influence on the sources of interference and control speed).
This situation can have an adverse effect on the comfort with room temperature control using blower convectors.

In an open-plan office with ceiling cooling employing fans, the outlet air is discharged near persons seated in the room. The thermostat is installed a few meters away. The thermostats detection of the change in temperature is delayed because of this distance, and the persons are subjected to cool air directly in their immediate surroundings for an extended period.

Solution:
The temperature is not measured on the wall but rather in the vicinity of the blower convector, e.g. at the air-intake into the system. The control response of the overall system is faster; the climate control in the room is more comfortable.

The room thermostat Fan Coil with Display RDF/A 1.1 and the room thermostat solo® TUS/U 1.3. and 2.3 offer the option of external temperature detection. It is also possible to use both temperature detectors (internal and external) for control purposes. Both parameters can be parametrised with a weighting. In this way it is possible to implement a very individual and optimised control.

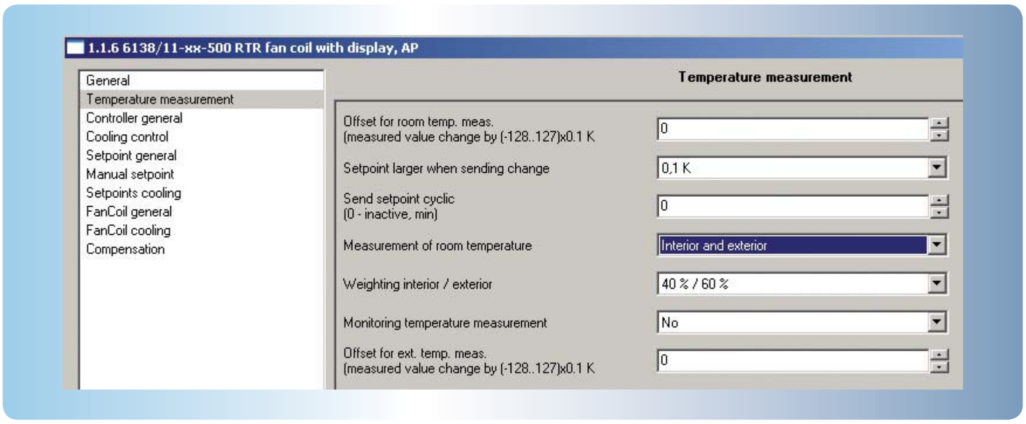


Fig. 46: RDF/A 1.1 temperature measurement parameters

7.2. Temperature control and window contacts

A frequent waste of energy in the area of HEATING and COOLING occurs with operation when the windows are opened. Windows are often open in a tilted position for many hours; the primary task of ventilating the rooms is insufficient, and undesired heating or cooling of the room occurs.

The classical solution with KNX entails the use of window contacts connected via a binary input. Alternatively, a zone terminal is used, which offers line monitoring via an end of line termination resistor. In this way, the window contact can be additionally used for safetyrelevant applications.

The communication object of the input connected with the contact is assigned to the communication object *Building protection* (with HEATING) or *Heat protection* (with COOLING) of the thermostat.
Building protection (frost protection) means a low setpoint (standard is 7 °C), which can be adjusted in the parameters. This means that there is no heating with an opened window and a room temperature of at least 7 °C.

Activation of heat protection with cooling means an increased setpoint, and cooling is practically stopped.

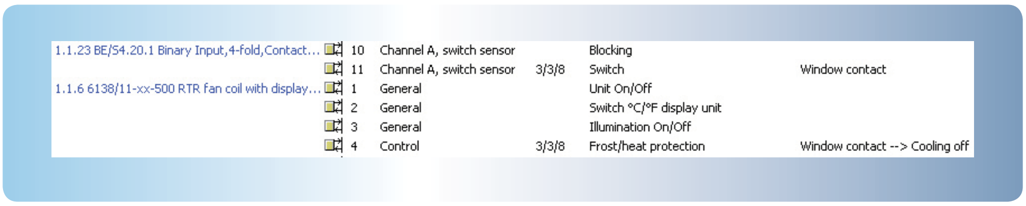


Fig. 47: Connection of window contact binary input with building protection on the thermostat

7.3. HEATING or COOLING additional stage

All ABB i-bus® thermostats offer the option of activating an additional HEATING stage. The room thermostat Fan Coil with Display RDF/A 1.1 as well as the room thermostat solo® TUS/U 1.3. and 2.3 also feature a additional COOLING stage.

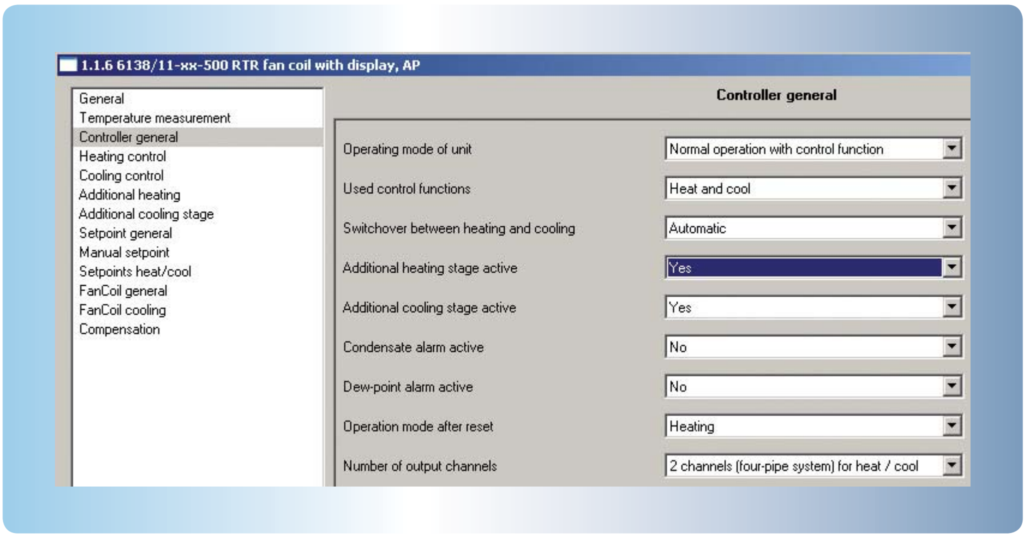
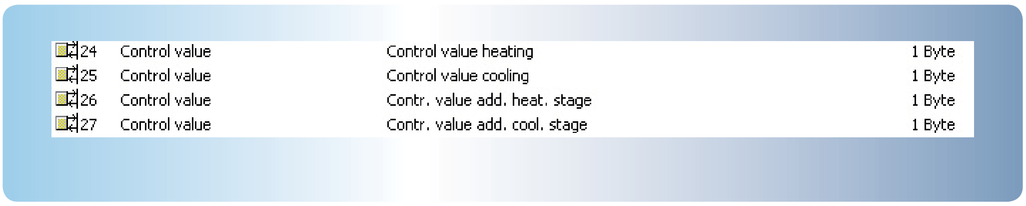


Fig. 48: RDF/A 1.1 with HEATING and COOLING additional stages

Two communication objects are available each as a control value.



24	Control value	Control value heating	1 Byte
25	Control value	Control value cooling	1 Byte
26	Control value	Contr. value add. heat. stage	1 Byte
27	Control value	Contr. value add. cool. stage	1 Byte

Fig. 49: Communication objects additional HEATING and COOLING stage

HEATING
The control value HEATING is used for control of the basis heating in a bathroom, e.g. for floor heating. A radiator is installed for quick heating that is controlled via the communication object *Control value additional stage HEATING*.

COOLING
The control value COOLING is used for regulating the basis cooling in a conference room, e.g. a cooling ceiling. A blower convector is mounted for quick cooling and is controlled via the communication object *Control value additional stage COOLING*.

The temperature is specified in the parameters of the thermostat, e.g. below this temperature during HEATING the additional stage will be activated. This is then the setpoint for the additional stage, i.e. it is controlled independently of the basis stage. If the room temperature reaches the setpoint for the additional stage, it will be switched off.

7.4. Communication between Electromotor Valve Drives ST/K 1.1

The Electromotor Valve Drives ST/K 1.1 have a special communication object for communication between one another as well as a central KNX module in the boiler control.

For further information see product manual Electromotor Valve Drive ST/K 1.1, chapter 3.5.

Here is an excerpt from this manual for boiler control via the maximum control value:

“If all the valve drives in the installation are only opened slightly e.g. one at 5 %, one at 12 %, another at 7 %, the boiler can lower its capacity because only a low level of heating energy is required.
To guarantee this, the boiler requires the following information:
What is the actuating value in the room which currently has the greatest heat demand?
This task is adopted by the Electromotor Valve Drive ST/K 1.1 using the function “Determine maximum position”.
Each valve drive compares the received actuating values with its own actuating value.
The valve drive with the largest actuating value sends its value via the KNX.”

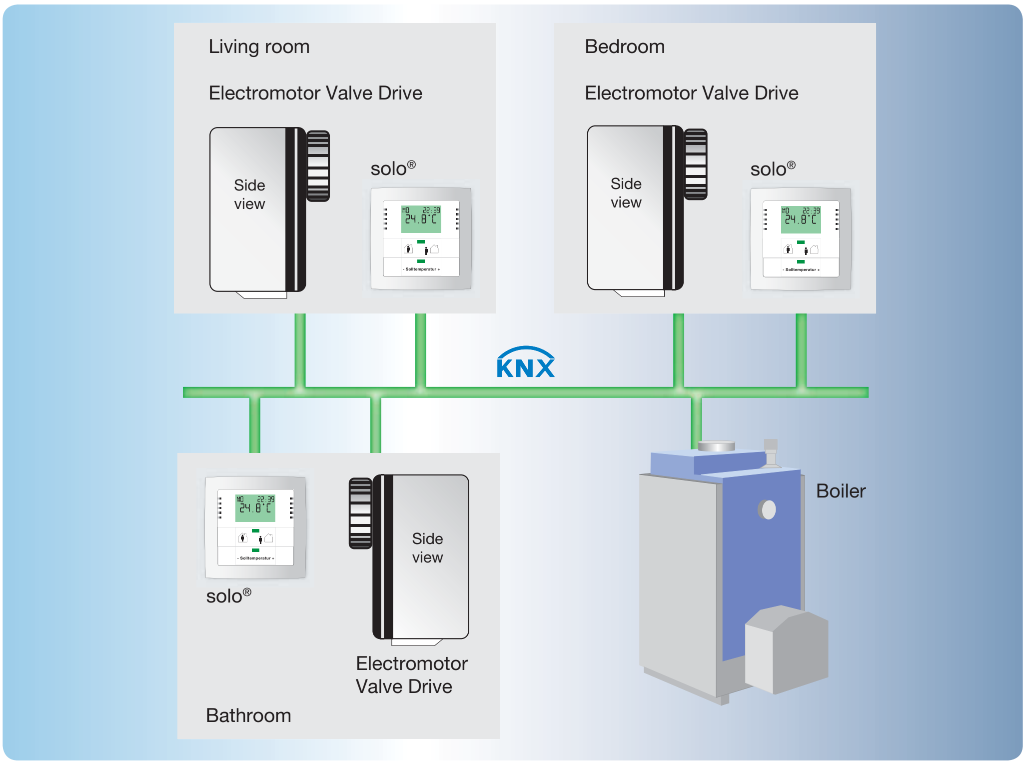


Fig. 50: Principle representation of communication between electromotor valve drives

“The comparison of the actuating values takes place via the communication object “Maximum position”. To do so, a common group address for sending and receiving the maximum position is linked with the communication object.To start the comparison of the actuating values among the bus devices, one device must send its value cyclically to this group address.

The task can be adopted either by the boiler or one of the valve drives. If the boiler carries this out, it must send the smallest possible value i.e. 0 %
If one of the valve drives ST/K 1.1 carries this out, the parameter Transmission of object “max. actuating value” for heating system in the parameter window “Security and forced mode” must be set to a cyclic period. This valve drive then sends its own actuating value at regular intervals and the others can react to it. Regardless of which bus device functions as a trigger, the parameter Transmission of object “max. actuating value” for heating system must be set to the default value “Only if own actuating value is higher” for all other valve drives.”

Prerequisite for this function is the installation of a KNX module in the boiler control, e.g. from Buderus or Viessmann.

This solution is oriented on the heat quantity in the boiler and not on a heating system operated with an external temperature controlled characteristic.

7.5. Maintenance of blower convector filters

In blower convectors, you will generally find filters in the inlets and outlets that require regular cleaning and maintenance. Recording of the operating time would be ideal, i.e. maintenance or cleaning of the filter is undertaken after a defined number of operating hours.

Solution:
The Fan Coil Actuators FCA/S can send a status message if the fan is operating at any speed, i.e. the blower convector is operational. This status message is sent to the Data Logging Unit BDB/S 1.1 that records the operating times. The operating hours value can be sent via the bus.

Additionally, an operating hours threshold can be programmed. A telegram is sent should the threshold be reached. This indicates that it is time for maintenance

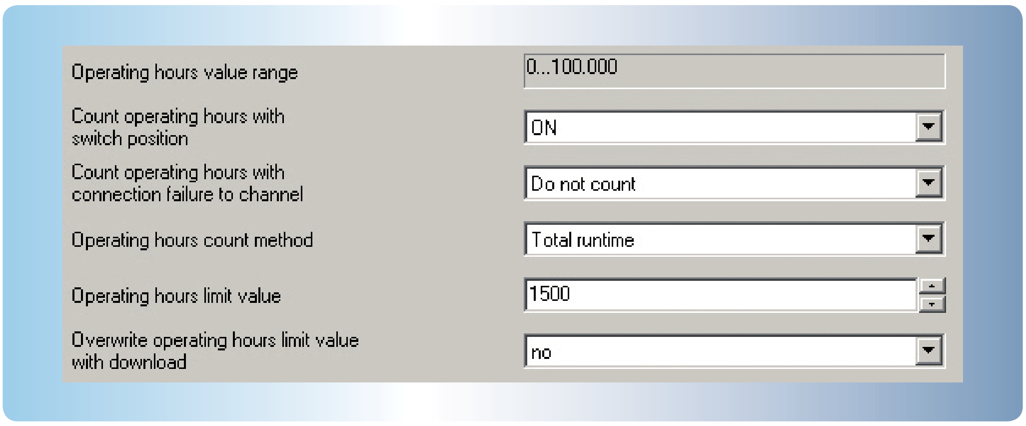


Fig. 51: Data Logging Unit BDB/S 1.1 parameters for operating hours

7.6. Valve purging

Valve drives for HEATING are not operational during the summer period. There is a danger that deposits will cause the valve to stick and that the valve will not be operational at the start of the heating period. Time-consuming disassembly and cleaning of the valve is the result.
In order to prevent this, it is possible to open and close the valve regularly during the summer. This function is available in all actuators for controlling valves and can be initiated either cyclically, e.g. once a week; or by an external telegram, e.g. by a clock.

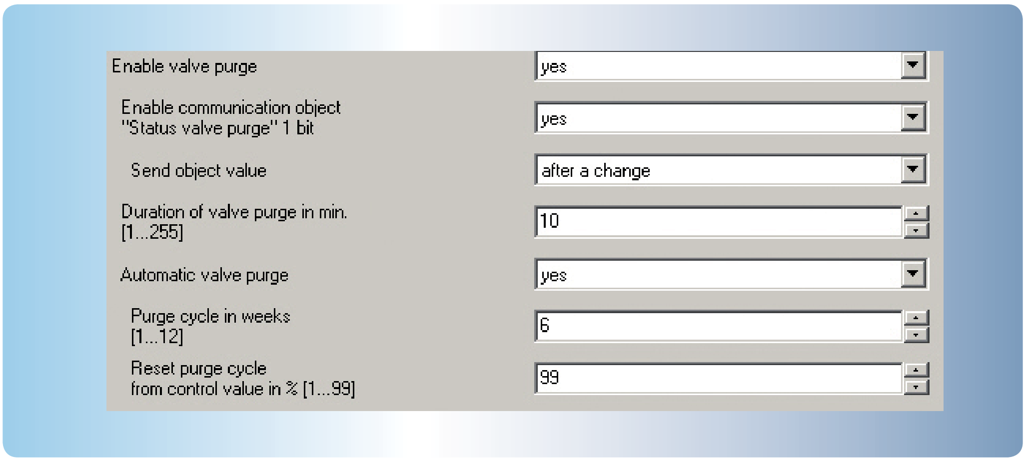


Fig. 52: Fan Coil Actuator FCA/S 1.1M parameters for valve purge

Checklist

Individual room temperature control, Heating/Ventilation and Air Conditioning (HVAC)

Building: ______________________________

Floor: ______________________________

Room: ______________________________

Smallest controlled unit No. ______________________________

Function: ______________________________

Planned facilities:

- ❑ Warm water radiator
  - ❑ Number of radiators ______________________________
    - ❑ Common circuit/valve for all radiators
    - ❑ Separate circuits/valves
  - ❑ Valve drive
    - ❑ Electro thermal 230 V AC via actuator)
    - ❑ Electro thermal 24 V AC/DC (via actuator)
    - ❑ Electro motorical (direct bus connection)
    - ❑ Valve drive at radiator
    - ❑ Valve drive in distribution board
- ❑ Location of radiator ______________________________
- ❑ Location of distribution board______________________________

- ❑ Warm water floor heating system
  - ❑ Number of circuits ______________________________
    - ❑ Common circuit/valve
    - ❑ Separate circuits/valves
  - ❑ Valve drive
    - ❑ Electro thermal 230 V AC (via actuator)
    - ❑ Electro thermal 24 V AC/DC via actuator)
    - ❑ Electromotive (direct bus connection)
  - ❑ Location of circuits ______________________________
  - ❑ Location of distribution board ______________________________

Checklist

- ❏ Electrical radiators
  - ❏ Number ____________________
  - ❏ Nominal voltage ____________________
  - ❏ Current required ____________________
  - ❏ Location of mounting ____________________

- ❏ Electrical floor heating system
  - ❏ Number ____________________
  - ❏ Nominal voltage ____________________
  - ❏ Current required ____________________
  - ❏ Location of mounting ____________________
  - ❏ Location of circuits ____________________

- ❏ Fan Coil unit
  - ❏ Supplier ____________________
  - ❏ Type ____________________
  - ❏ 4 pipe system
  - ❏ 3 pipe system
  - ❏ 2 pipe system
  - ❏ 1-level fan
  - ❏ 2-level fan
  - ❏ 3-level fan
  - ❏ Electromotive valve
    - ❏ Direct bus connection
    - ❏ 2-step valve drive OPEN/CLOSED
    - ❏ 3-step valve drive 0…100 %
    - ❏ Analogue proportional valve drive (e.g. 0...10 V)
- ❏ Electro thermal valve drives
  - ❏ Normally open (without voltage)
  - ❏ Normally closed (without voltage)

Checklist

Local operation and indication

- ❑ **Room thermostat**
  - ❑ Supplier ______________________________
  - ❑ Design ______________________________
  - ❑ Temperature setpoint adjustable
  - ❑ Temperature setpoint moveable
  - ❑ Switching to Frost protection mode
  - ❑ Switching to Comfort mode
  - ❑ Switching to Night mode
  - ❑ Party button (time for limited extension of Comfort mode)
  - ❑ Display of room temperature
  - ❑ Display of setpoint
  - ❑ Display of outside temperature
  - ❑ Display of operating mode (Comfort/Night/Frost protection)
  - ❑ Additional functions: ______________________________
  - ❑ Location ______________________________

Checklist

Superior manual operation

- ❑ Central switching
  - ❑ Central changeover to Frost protection mode
  - ❑ Central changeover to Night mode
  - ❑ Central changeover to Comfort mode
  - ❑ Central activation of fixed setpoints
  - ❑ Central adjustment of any setpoint
  - ❑ Location of superior central operation ________________

- ❑ Switching in groups
  - ❑ Number of groups ________________________________
  - ❑ Description of groups ______________________________
  - ❑ Changeover of groups to frost Protection mode
  - ❑ Changeover of groups to Night mode
  - ❑ Changeover of groups to Comfort mode
  - ❑ Changeover to fixed setpoints
  - ❑ Changeover to any setpoint
  - ❑ Location of superior operation in groups ______________

- ❑ Intergration in Scenes
  - ❑ Number of Scenes ________________________________
  - ❑ Name of the Scenes _______________________________
  - ❑ Behaviour in case of recalling the Scene ______________

Checklist

Local automatic control

- ❏ Control in case of any local event
  - ❏ Window open HEATING/COOLING deactivated
  - ❏ COOLING switched off
    if dew point has been reached ____________________
  - ❏ Change between Comfort/Night mode by Presence detector

  - ❏ Timer
  - ❏ Yearly timer
  - ❏ Weekly timer
  - ❏ Number of day routine ____________________
  - ❏ Number of special days ____________________

  - ❏ Presence detector
  - ❏ Change to Comfort mode in case of absence
  - ❏ Change to Night mode in case of absence

  - ❏ Integration in Scenes
  - ❏ Number of Scenes ____________________
  - ❏ Behaviour in case of recalling a Scene ____________________

  - ❏ Controlled by any other superior event
  - ❏ ____________________
  - ❏ ____________________

Checklist

Security functions

- ❑ Behaviour if dew point has been reached
  - ❑ Cooling OFF
  - ❑ Ventilation ON
  - ❑ Heating ON
  - ❑ ____

- ❑ Behaviour if maximum temperature has been reached
  - ❑ Cooling ON
  - ❑ Ventilation ON
  - ❑ Heating OFF
  - ❑ ____

- ❑ Behaviour in case of Frost alarm
  - ❑ Heating ON
  - ❑ Open valve drive ca. _____%
  - ❑ ____

Operation/Indication via remote access

- ❑ Remote control
  - ❑ Via telephone
  - ❑ Via LAN
  - ❑ Via Internet

- ❑ Status message
  - ❑ Visualisation
  - ❑ Via telephone
  - ❑ Via LAN
  - ❑ Via Internet

Checklist

Special functions

- ❑ Local operation disabled at certain times
  - ❑ Time: ____________________________________
  - ❑ Behaviour if blocking is disabled
    - ❑ Comfort mode
    - ❑ Night mode
    - ❑ Frost protection mode
    - ❑ Situation as before

- ❑ Local Operating disabled in case of a defined event
  - ❑ Event: ____________________________________

- ❑ Function flexible wall
  - ❑ In case of open wall controlled with room thermostat ____________________________

Notes

Notes

Contact

www.abb.com/knx

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