

The room thermostat application module with 2-fold switch sensor is placed on a flush-mounted bus coupler.

The room thermostat with 2-fold switch sensor offers the possibility of implementing single room control and simultaneously sending switching, value, dimming, shutter control or ventilation control telegrams to EIB actuators. The module can likewise be used for storing and/or sending lightscenes.

The room thermostat with 2-fold switch sensor has two contacts under each

rocker and an LED, which glows red or green.

The display indicates the current set-point or actual temperature and the current operating modes. The time and/or date is displayed in an additional line. Depending on the setting, this line can also indicate e.g. values such as the temperature of an external sensor.

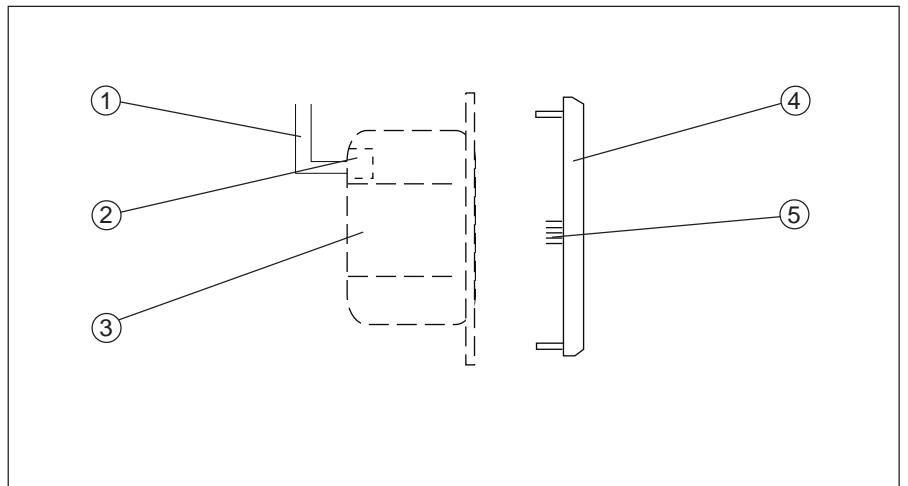
A cover frame in the desired colour in the solo®, future or carat design is also required together with a flush-mounted bus coupler and a bus connecting terminal.

Technical data

Power supply	– EIB	24 V DC, via the bus line	
Operating and display elements	– 2 rockers, each with 2 push button contacts		
	– 2 x two-colour LEDs	red / green	
	– 1 display	to display temperature and operating modes	
	– 1 additional button	for toggling the modes of the room thermostat	
Connections	– Bus coupler FM (6120 U-102)	10-pole plug connector	
Type of protection	– IP 20, EN 60 529	mounted on the flush-mounted insert	
Ambient temperature range	– Operation	- 5 °C ... 45 °C	
	– Storage	- 25 °C ... 55 °C	
	– Transport	- 25 °C ... 70 °C	
Design / colour	– solo®	savanna / ivory davos / studio white manhattan / graphite samoa / light green toscana / crimson attica / blue-grey	
	– future	savanna / ivory davos / studio white manhattan / graphite stone / light grey	
	– carat	anthracite savanna / ivory davos / studio white	
	Installation	– latched onto the flush-mounted insert	
	Dimensions	– 63 x 63 mm (H x W)	
	Weight	– 0.04 kg	
Certification	– EIB-certified		
CE norm	– in accordance with the EMC guideline and the low voltage guideline		

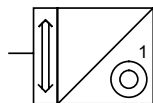
Application programs	Number of communication objects	Max. number of group addresses	Max. number of associations
For bus coupler FM: Switch Dim. Shu. Value Vent. LS Heat Cool PL/1	20	20	20

Circuit diagram



- 1 Bus cable
- 2 Bus terminal
- 3 Bus coupler FM

- 4 Application module
- 5 10-pole plug

**Switch Dim. Shu. Value Vent. LS Heat
Cool PL/1****Selection in ETS2**

- ABB
 - └ Heating, air-con., ventilation
 - └ Thermostat

The room thermostat application module with 2-fold switch sensor is placed on a flush-mounted bus coupler. The module has different operation modes and set-point temperatures for heating or cooling a room. The operation modes of the controller and the setpoint temperatures are selected and modified via the bus or the rockers.

The rockers can be assigned various functions. They thus send switching, dimming, shutter, value or lightscene telegrams when they are pressed.

Depending on the parameter settings, different communication objects are hidden or displayed.

Operation modes of the rockers

The function is first defined via the parameter "Operation mode of rocker". The ETS program then displays the relevant objects and parameters for the required function.

The functions of the rockers are described in the following section. The functions are identical for both rockers.

Switch sensor

If the operation mode of the rocker is defined as "Switching sensor", the switch sensor sends "ON" or "OFF" telegrams via the relevant 1 bit object "Rocker - Switching".

In the default setting, the switch sensor sends "TOGGLE" telegrams when the right or left rocker is pressed. This means that an "ON" command is sent first followed by an "OFF" command after a push button action and then an "ON" command if the rocker is pressed again.

Via the parameter "Working mode of the rocker", the rockers can also be set so that the right rocker sends "ON" commands and the left rocker sends "OFF" commands or vice versa.

Dimming sensor

In the operation mode "Dimming sensor", an "ON" or "OFF" command is sent to the 1 bit communication object "Rocker - Switching" when one of the rockers is pressed briefly. If the rocker is pressed for a longer period, the switch sensor sends commands for dimming brighter or darker to the 4 bit object "Rocker -

Rel. dimming". If the rocker is released after a long push button action, the switch sensor sends the command "Stop dimming".

In the default setting, the switch sensor sends "TOGGLE" telegrams after a short operation of the right or left rocker. A long operation of the left rocker dims down the brightness level while a long operation of the right rocker dims up the brightness level. This behaviour is adapted if required via the parameter "Working mode of the rocker".

Shutter sensor

In the operation mode "Shutter sensor", the switch sensor has the 1 bit communication objects "Move up/down" and "Lamella adj./Stop". After a long operation of the rocker, the switch sensor sends telegrams to the connected shutter actuators to raise or lower the shutter. After a short operation, it sends telegrams to stop the shutter movement or for louvre adjustment.

The setting "Working mode of the rocker" defines whether the shutter is raised or lowered after operation of the right or left rocker.

Flexible allocation

With the application "Flexible allocation", the right and the left side of the rocker of the switch sensor each have their own 1 bit communication object "Rocker - Switching" available. It is possible to send "ON", "OFF" or "TOGGLE" telegrams on the EIB via this object.

Each pulse edge of the rockers can therefore be set individually. The switch sensor can thus be adapted to a wide variety of applications. If e.g. inching mode should be implemented, the setting "rising = ON, falling = OFF" should be selected.

With the parameter setting "no reaction", it is possible to completely deactivate a rocker.

LED

The relevant LED of the rocker can display the current status of the object "Rocker ..." or serve as an orientation light.

If the LED is used for status display, the colour changes when the object value changes. It can freely selected whether

the LED lights up “green” or “red” in the OFF state or “red” or “green” in the ON state.

The LED can light up “green” or “red” as an orientation light.

Lightscene sensor

In the operation mode “Lightscene sensor”, the switch sensor sends a 1 byte value via the relevant object “Rocker ... - Lightscene number”. This value is assigned to a specific lightscene.

Two different lightscenes per rocker can be stored and recalled. The parameter setting “Left rocker sends lightscene number” and “Right rocker sends lightscene number” specifies which lightscene is recalled by the respective push button.

If the common group address is linked with a “Lightscene number” object of a rocker of another switch sensor (e.g. 4-fold multifunction switch sensor solo®), two lightscenes can also be retrieved by this rocker. A prerequisite is that the application “Lightscene sensor” has been set for this rocker as well as the correct lightscene number.

If lightscenes that are stored in the device itself need to be retrieved, it is important that the lightscene numbers that have been set for a rocker are also set on the “Lightscene” parameter page.

The lightscene is saved via a long push button action, provided that the parameter “Storage of lightscenes via a long push” has been set accordingly. All the actuators are dimmed or switched to the required brightness value before saving the scene. A long operation (approx. 4 s) takes place of the left or right push button of the rocker which should recall the corresponding lightscene.

Note:

To save the lightscenes, the read flag (R flag) must be set in the corresponding communication objects of the actuators.

The status LED of the corresponding rocker flashes while the lightscene is being saved.

If the lightscene storage should be carried out in the switch sensor, the parameter “Lightscenes stored in device” should be activated.

The parameter “Lightscene number for lightscene ...” defines which lightscenes can be saved by the switch sensor. A maximum of 2 lightscenes can be stored per room thermostat with 2-fold switch sensor. The number of lightscenes is specified with the setting “Number of lightscenes”. If more lightscenes are required, a further EIB multifunction switch sensor must be used. If an additional switch sensor is used, the parameters “Lightscene number” must be changed accordingly so that the same lightscenes are not used twice.

The “Lightscene number” object of the rocker (object no. 0 or no. 2) is linked with the “Lightscene actuator - Lightscene number” object no. 15 via a common group address. If the group address of the “Lightscene actuator - Lightscene number” object (no. 15) is received, it sends telegrams to switch or dimming actuators via the objects “Actuator group A” to “Actuator group D”.

The actuator groups can be set as 1 bit or 8 bit. The preselection of the lightscene values is carried out on the “Lightscene ...” parameter page. This can be “OFF/UP” or “ON/DOWN” for 1 bit values. In the case of 8 bit values, it can be set between 0% and 100% in steps of 10%.

Switch sensor value

The operation mode “Switch sensor value” causes the switch sensor to send 1 byte value telegrams via the relevant object “Rocker - Value”.

By default, the value “1” is sent when the left half of the rocker is pressed while the value “0” is sent when the right half of the rocker is pressed.

The values that should be sent can be defined via the parameters “Left rocker sends value” and “Right rocker sends value”. These values can range between 0 and 255.

It is thus possible e.g. to switch on a dimming actuator with a specific brightness value or if it is already switched on, to change the brightness level to a specific value.

Continuous ventilation

In the operation mode “Ventilation continuous”, the rocker has a 1 byte commu-

nication object "Rocker ... - Value". Percentage values are sent to "Ventilation actuators" (0=0 %, 255=100 %) at this object which can thus set the flap position of ventilation valves.

It can be set whether the ventilation flap is moved up or down with the right or the left side of the rocker.

If a push button of the rocker is pressed, the value is increased or reduced each time by 5 %. The current value is indicated in the display.

If the push button is pressed for a longer period, the value is "dimmed". This means that the value is dimmed up or down in the display in steps of 5 %. The corresponding value telegram is only sent approx. 3 s after the last operation.

It may be a requirement that the ventilation flaps should not be completely closed or opened. Via the two settings "Lower limit" and "Upper limit", it can be defined up to which value the ventilation flap can be opened or closed. Thereby the last object value on the bus is always relevant as initial point for the setting. After bus voltage recovery the object value is set to zero. Until the object value reaches the limits for the first time, lower or higher values can be sent.

LED (for switch sensor value and continuous ventilation)

In the operation mode "Switch sensor value", the status LED of the respective rocker displays the current status of the value object. If a telegram with a value \geq "1" is sent or received, the LED lights up red. If a telegram with the value "0" is received, it lights up green. This behaviour can be inverted via the parameter "Operation mode of LED".

Alternatively, the LED can also serve as an orientation light. To do so, the parameter "Operation mode of LED" must be set accordingly.

Room thermostat functions

The room thermostat with 2-fold switch sensor has an additional button to the right of the display. If this button is pressed, the module changes to RT mode. The current setpoint temperature and the controller mode can now be modified by the user for a short period (approx. 3 s). The module indicates the acti-

ve RT mode by flashing the temperature symbol in the display. The RT operating time can be extended to "approx. 6 s" via the LCD parameter "Switch back to general display ...".

During the RT operating time, rocker 1 is used for setpoint adjustment while rocker 2 is used for toggling between standby and comfort modes. Alternatively, the rockers can be deactivated in RT mode. If the setpoint adjustment function of rocker 1 is disabled, the setpoint temperature will not be shown.

The functions of the room thermostat are described in the following section.

LCD

The room thermostat has an LC display. The current room temperature (actual value) is indicated on this display by default. By changing the parameter "Temperature display at adjusting mode", the current setpoint or the relative setpoint which is produced by the setpoint adjustment via rocker 1 can also be displayed. The display can also be completely deactivated.

The setting "Display heat/cool is active" describes when the symbols for heating or cooling are displayed. The setting "at heating or cooling demand" means that the symbols are only shown if the heating or cooling actuator must be operated. With the setting "if operation mode is active", the symbols indicate the basic heating or cooling mode, regardless of whether there is actually a demand for heating or cooling.

The LCD can be illuminated if required. The parameter "Illumination LCD" is available for this purpose. It is therefore possible to switch on the LCD lighting for the RT operating time or to switch it on or off permanently.

In addition, the current operation mode and/or the time and date can be read in the LC display via different symbols. The display of the time and date is dependent on the "Information line" parameters. No date or time is shown by default.

Information line

The information line is displayed only if the parameter "Edit info row" has previously been set to "yes" and a telegram was received with the value > 0 for the first time.

If e.g. the current time or date should be read in the information line, the parameter "Content of information line" should be set accordingly. In addition, the group address "Time" and/or "Date" must be linked with the corresponding object of the RT. The time and date can be issued e.g. by a visualisation program or a clock with a DCF77 receiver.

Temperatures (EIS 5) or values (EIS 6) can likewise be displayed in the information line. To do so, the parameter "Content of information line" must be set accordingly.

The ETS program then either displays an additional 2 byte communication object "Temperature (EIS 5) - Information line" or a 1 byte communication object "Value (EIS 6) - Information line". If a telegram is received, it is displayed accordingly in the information line. Temperatures of another room thermostat or the current position of a ventilation flap can thus be shown.

If a temperature should be displayed, the unit e.g. °C or °F is also indicated. The unit can also be hidden.

In the case of a value display, the "correct" 1 byte value from 0 to 255 can be shown. Alternatively, the display can convert the received values into percentage values of 0 to 100 % (0=0%, 255=100%).

It is possible to represent three characters in front of the value. An information line (of office 1) could thus look as follows:

O1 21°C

Operation modes

The room thermostat has four operation modes:

- Frost protection mode: The room thermostat is out of service; heating is only carried out if the room temperature drops so low that there is a risk of the heating installation freezing.
- Comfort mode: The setpoint for the room temperature is set to a value which enables normal use of the room at a pleasant temperature.
- Standby mode: The room temperature drops so low (e.g. during periods of absence) that the heating costs are saved. The comfort temperature can however be reached again quickly.
- Night operation: The room is not used for long periods during the night; the room temperature is reduced to a pleasant temperature during the night and can be raised relatively quickly again in the morning.

It is possible to switch between these operation modes using switching telegrams (see also the diagram of the operation modes). The frost/heat protection mode has the highest priority (see Fig. 1) i.e. it is not possible to switch to another operation mode in this case. The frost/heat protection mode must first be deactivated e.g. by closing an opened window. Comfort mode has the next highest priority followed by night operation. If none of these three operation modes are active, the room thermostat is in standby mode.

Party time (comfort extension)

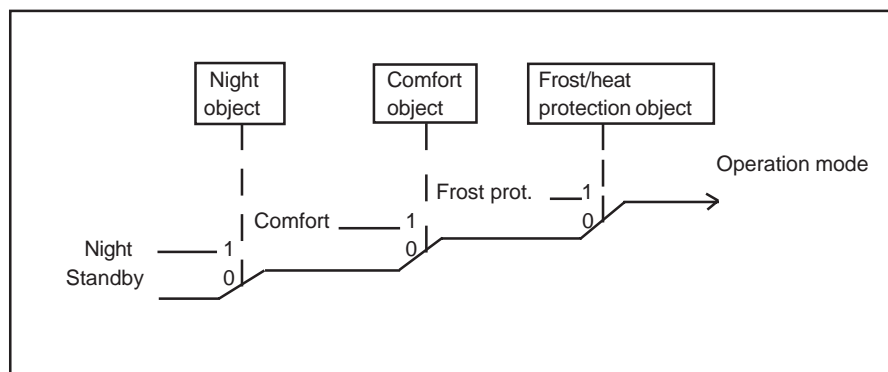
If the room thermostat is switched to night operation via the bus, it is possible to activate party time by pressing the right side of rocker 2 (changes to comfort mode). Once the party time has elapsed, the thermostat switches back to night operation.

During the party time, the symbols for night operation and comfort mode are shown on the display. By pressing the left side of rocker 2, the party time can be manually reset to night operation.

This function can also be used for the temporary deactivation of heat and frost protection modes. As during night operation, the device switches to comfort mode for the set period. The switching on and off of the function is carried out in the same way. During this comfort

Figure 1

Priorities of the operation modes



extension, the symbols for frost protection and comfort are indicated on the display.

The second rocker with the operation mode switching comfort standby activates the comfort object directly, if the party time is inactive. Consequently the operation mode can be switched directly from night mode to comfort mode. If frost protection or heat protection are active, the changeover of the second rocker is stored in the comfort object.

Measuring of the current temperature is usually made with the internal sensor. With the parameter "Measurement of current temperature" it can be changed to external measurement. Hereupon the value of the communication object "Current temperature" is used for the internal operation. If no value is received for 30 minutes, the room temperature controller is blocked and no output telegrams are sent.

Setpoints

The following setpoints can be set for the heating mode: "Base setpoint in °C (16..35) (comfort temperature)", "Reduced heating in standby mode in K (1..8)", "Reduced heating during the night in K (1..12)" and "Setpoint frost protection in °C (5..10)".

The comfort temperature for the cooling mode can be set via the "Insensitive range between heat and cool in K (1-10)". The setpoints for standby and night operation refer to this value: "Increased cooling in standby mode in K (1..8)" and "Increased cooling during the night in K (1..12)".

If cooling should take place at 25°C e.g. with a base setpoint of 22°C in comfort mode, an insensitive zone of

3°C must be set. If cooling should then take place in standby mode at 27°C, the value must be increased by 2°C. An increase of 4°C is required for cooling during night operation from 29°C.

To prevent the uncontrolled overheating of rooms, it is possible to preselect a setpoint for heat protection mode to specify when cooling should take place. If heat protection is not required, the cooling can be switched off. In this case, the value 99.9°C is shown on the display on receipt of an "On" telegram at the frost/heat protection object instead of the current setpoint and the value "99.84 °C" is sent on the EIB.

The base setpoint can be modified via the bus as often as required. To do so, a 2 byte temperature value must be sent to the object "Base setpoint".

The setpoint temperature can be manually changed with the first rocker. The parameters "Range for manual setting of the setpoint", "Max. increase of setpoint at heating" and "Max. reduction of setpoint at cooling" specify the scope for changing the setpoint. If a new telegram is sent to the communication object "Base setpoint" after a manual setpoint adjustment, it is thus also possible to reverse the manual setpoint adjustment again.

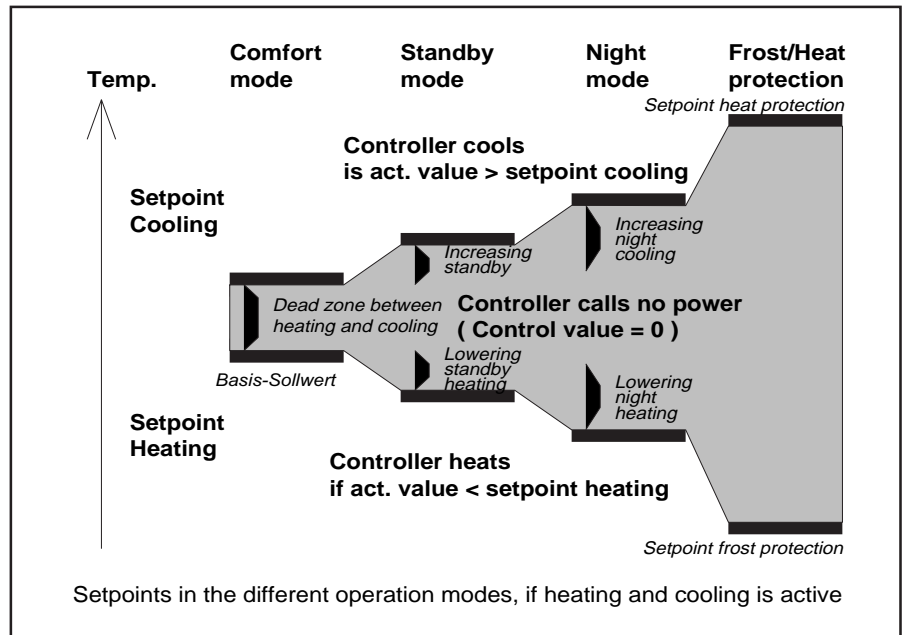
Heat / Cool

So that the room thermostat can address the various controller types for heating or cooling mode, it can be parameterised as a continuous or switching controller. In the case of a switching controller, it is possible to choose between a PWM controller and a 2-step controller.

In the case of a continuous control response and a switching PWM control-

Figure 2

Setpoint values in the different operation modes.



ler, the preset control parameters can be used via the system type of the heating or air conditioning system. If other control parameters are required, they can be set individually via more detailed parameterisation. This should only be used if you have sufficient experience in the control technology.

The continuous controller issues its control value to a 1 byte object. To protect electrothermal valves which are connected to heating actuators with PWM control, it is advisable to limit the dynamic range. This is carried out via the parameter "Minimum control value" or "Maximum control value". To prevent unnecessary loading of the bus, it is possible to specify the size that the change at the control value must reach in order to be sent on the bus. The setting is carried out as a percentage value. The sending of the control value is also restricted by a cyclic period if it has not been changed. This cyclic period should not be too short (e.g. every 10 min).

In the case of a switching PWM controller, the output value of the controller (0...255) is converted into ON/OFF control. If e.g. a control value of 70% should be sent, the ON time should be set at 7 minutes and the OFF time at 3 minutes with a preset cyclic period of 10 minutes. The dynamic range can be restricted as with the continuous controller. If e.g. a ma-

ximum control value of 80% is selected, the controller automatically sends a control value of 204 when the value is exceeded.

To optimise the control characteristics of the heating or cooling system, the "Cyclic time of the switching control value" can be set. The type of heating or cooling as well as the valve drive used must be taken into account when setting the cyclic time. The following recommendations can be implemented:

- a) Electrothermal valve drive:
To open a thermoelectric valve drive fully takes approx. 2-3 minutes. A shorter cyclic time than 15 minutes is therefore not advisable.
- b) Floor heating
The time constant for floor heating is very large. A cyclic time of 20 minutes is therefore sufficient.
- c) Warm water heating
Thermoelectric valve drives are often used in this case. A cyclic period of 15 minutes produces extremely good results.
- d) Electric convector heating
Cyclic times between 10 and 15 minutes are recommended, depending on the electric heating and conditions in the room.

If a 2-step controller is used for heating or cooling control, it is possible to select various levels for the hysteresis by which the setpoint fluctuates. For example, if the setpoint during heating

mode is at 20°C and the hysteresis is at 0.5 K, the controller switches on at 19.75°C and off again at 20.25°C. The hysteresis is then based on how quickly the heating system can warm up the room or how quickly the cooling system can lower the temperature in the room as well as the customer's sensitivity to temperature levels. The hysteresis should not be set too low as otherwise the valve drive continually opens and closes. It should also not be set too high as the temperature fluctuations in the room are then fairly considerable.

The parameter "Reduction of hysteresis" is used to increase the level of accuracy of the controller. If this parameter is activated, the hysteresis is reduced for example every minute by 0.1 K until it reaches 0 K, if required. There is effectively a decrease in the temperature fluctuations during the closed-loop control as a result of the reduction in the hysteresis. If a reduction should be used, it is advisable to set it at less than a fifth of the hysteresis.

e.g. Hysteresis 0.5 K =>
Reduction < 0.1 K/min

In certain cases (underfloor heating), it can be necessary to install a fast-acting additional level for the heating control in order to be able to heat the room up quickly. In the setting "2-step heating", the room thermostat can control a second heating system via a switching controller (1 bit) or via a semi-continuous controller with the 1 byte values of 0% and 100%.

With the parameters "Setpoint difference of basic heating to additional heating" and "Hysteresis (one-sided)", it is determined when the additional level is switched on and when it is switched off. If for example the setpoint of the additional heating is set to 18°C and the hysteresis is 0,5 K (one-sided), the controller switches on at 18°C and switches off at 18,5°C.

As some valve drives close following a 1 byte value of "255" or a 1 bit value of "1" and open at other corresponding values, the "Mode of control output" can be inverted.

The toggling between heating and cooling is carried out automatically by the room thermostat. If this is not required, the "Toggle between heat and cool" can be carried out by an external, central controller via the 1 bit object "Operation mode - Heat/cool". In this setting, the heating or cooling symbols are permanently visible during the corresponding operation mode. The object is enabled via the parameter "Toggle between heat and cool".

Automatic shading

To prevent the room from warming up due to sunlight, automatic shading can take place by lowering one or several blinds. The shading object "Telegr. move up/down" is used for this purpose.

The parameter "Automatic shading ..." determines at which temperature the blinds should be lowered.

If the temperature again falls below the set shading temperature, no command is issued to raise the blinds. The blinds can be raised e.g. at a specific time using a central command.

Group master mode

In large open-plan offices for example, it can be difficult to achieve a good level of control throughout the room with only one room thermostat. For these cases, it is possible to divide the room into several zones with a room thermostat in each zone. So that these thermostats always use the same setpoint value, it is possible to activate the parameter "Group master mode" for one of the devices. This device then has the 2 byte communication object "Base setpoint for slaves - Telegr. temperature" which is linked to the 2 byte communication objects "Base setpoint - Telegr. temperature" of the other devices. The manual setpoint adjustment should be disabled for these devices.

Offset

If the measured temperature becomes invalid because the bus coupler itself has warmed up, it is possible to set an "Offset for temperature measurement...".

The installation site of the thermostat and the suitable selection of parameter settings is a decisive factor in accurate temperature measurements.