User manual

KNX MultiController DALI

Article number: 5410x / 5411x

Picture: **KNX MultiController DALI** with Reed panel and sensor

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1 KNX MultiController

KNX MultiController is a room controller designed to be mounted above false ceilings or under flooring.

The main functions of the KNX MultiController:
- Controlling heating and cooling by thermo outputs
- Controlling general purpose loads by mechanical relays
- Controlling lighting through an embedded DALI master
- Binary inputs for switch, dimming, scene and shutter control
- Extensions for sensors, user panel, IR remote and analog I/O

See chapters 3 to 15 for programming and configuration.

See chapter 17 for wiring and installation instructions.

See chapter 18 for technical data.

2 Introduction

KNX MultiController is designed to be an efficient room controller system for office, hotels and commercial buildings. The core of the KNX MultiController is the combination of a DALI gateway for constant light regulation and demand controlled two-step temperature regulator with thermo shunt outputs for separate cooling- and heating control.

The functionality of the product can be configured and connected to the rest of the KNX automation system by using the ETS Tools Software (see www.knx.org)

Example – Heating regulator:
The KNX MultiController can be configured as a two-step heating regulator. The regulator has one temperature setpoint for a room that is occupied and another temperature setpoint for a room that is vacant. For example the heating temperature setpoint for an occupied room may be 22°C and the setpoint for the vacant room may be 19°C. The movement detector mounted in a standard wall- or ceiling box through an internal interface will detect a person walking into the room. The setpoint will be raised from 19°C in standby mode (vacant) to 22°C in comfort mode (occupied).
The thermostat output can be linked to either the mechanical relays for electrical heating cables, to the solid state outputs for thermo shunts or to other KNX actuators.

Example – Lighting:
The KNX MultiController can control luminaires through the DALI light control interface based on available daylight. When a person walks into the room and the temperature setpoint is changed from standby to comfort mode, the light will also be turned on and the constant light regulator will keep the light level at the configured lux-level. The setpoint for the constant light regulator can either be changed by parameters with the ETS tools software or by value and dim objects (digital inputs, IR remote control or other KNX switches). The KNX MultiController will learn the new lux setpoint and control the light accordingly.

Example – Ventilation:
The KNX MultiController can control ventilation for the office space by KNX objects based on the movement detector and the temperature regulator. The ventilation can be reduced to a minimum when the room is vacant and the controller is in standby mode. The ventilation system will be told to increase the ventilation when a person enters the room.
The ventilation system will usually have a cooling effect for the room because of lower air temperature in the supplied air. The cooling regulator of the KNX MultiController can activate added ventilation as required based on the room temperature.

Figure 1 - KNX MultiController user panel

Figure 2 - KNX MultiController Sensor (52011 or 52021)

3 Start-up and general functions

The KNX MultiController can be configured by using the ETS Tools Software. The product database file for KNX MultiController can be downloaded from http://www.function-technology.com/downloads. Documentation regarding parameters, objects and example configurations can be found in the chapters below.

The KNX MultiController can be set in programming mode either by pressing the "Switch" and "Mode" button simultaneously at the control panel, by pressing the switch behind the movement sensor lens or by a magnet. See Figure 3 for the control panel buttons and Figure 2 for the location of the programming mode button for the movement sensor.

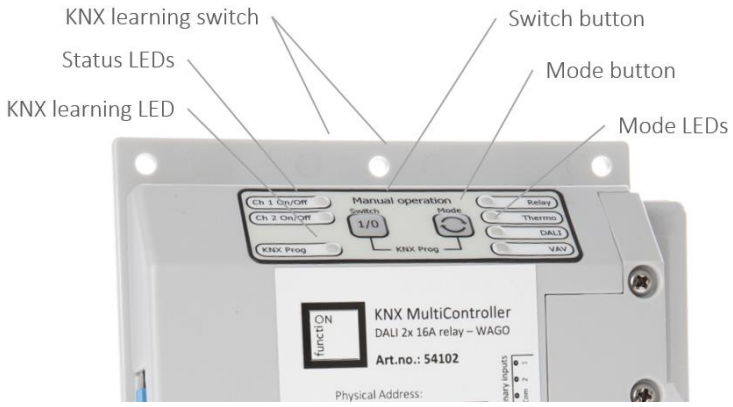


Figure 3 –KNX MultiController control panel

The red programming LED on the control panel and behind the movement sensor lens will be lit when the KNX MultiController is in programming mode. The programming LED will blink when the KNX MultiController is not programmed (un-programmed node).

The KNX MultiController will check communication with movement detector, temperature sensor and DALI interface. If communication has failed, the object "Device self-test status" will be set to "1". When the error situation is cleared, the "Device self-test status" object changes its value to 0.

The start-up functionality for a device that has not been programmed with ETS includes:

1. Switching on the mechanical relays
2. Thermo shunt outputs are turned off
3. Walk-in test for movement detection with the red LED behind the movement sensor lens
4. The binary input 1 and IR Remote Input 1 will have switch and dim functionality for the connected DALI lamps

Note: The KNX node includes basic functionality for test and commissioning purposes that will be removed after the first ETS download:

1. Digital input 1 switch and dim function for the DALI lamps.
2. Detection of movement is shown by a blinking red LED behind the movement detector lens.

3.1 General parameters

The status of the KNX MultiController is shown by the object "Self-Test status". For normal operational nodes this status object is low. If the DALI interface, movement- or temperature sensor does not respond, the Self-Test status is set high. The object can be configured to be sent cyclically [1 to 24 hours].

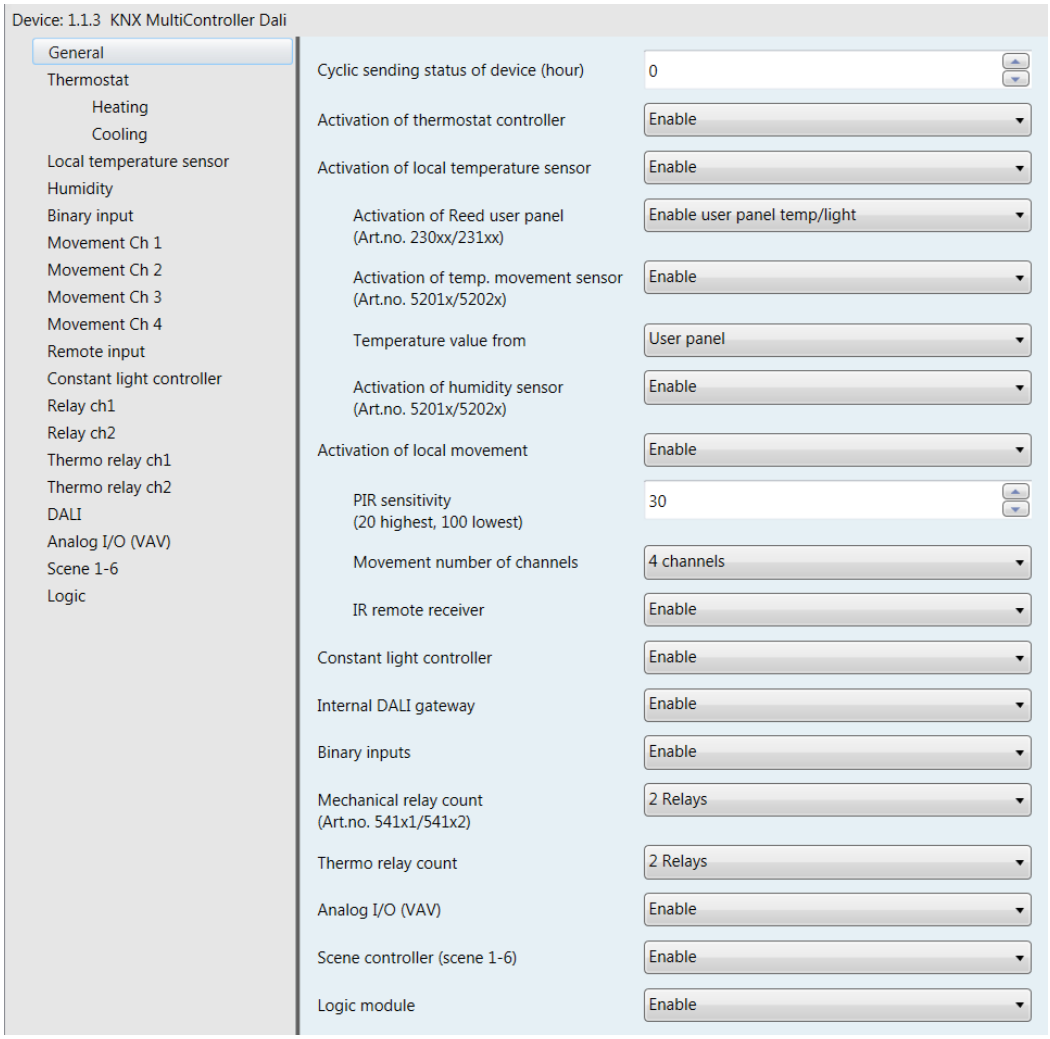


Figure 4 – General parameter window (Fully expanded)

The KNX MultiController can be configured with or without movement- and temperature sensors. The thermostat can still be activated based on external temperature object even without a local temperature sensor connected to the unit. The general parameter window with expanded parameters is shown in Figure 4.

The movement sensor comes in three versions:

- 52001 2Sense MC, movement / lux
- 52011 4Sense MC, movement / lux / temp / humidity
- 52021 5Sense MC, movement / lux / temp / humidity / PT1000

PIR sensitivity can be adjusted from 20 to 100, where 20 is the highest sensitivity. The parameter is set to 30 by default and should not be set lower than this value without testing for false detection.

3.2 Temperature sensor

The thermostat can use either the temperature from the movement sensor, user panel (Figure 1) or external communication object. If the KNX MultiController is connected to both a movement sensor with temperature sensor and the user panel it is possible to choose which temperature measurement to use (see Figure 5).

The local temperature measurement resolution can be set at either 0.5K or 0.1K and can be combined with an external temperature based on a percentage parameter (see Figure 6).

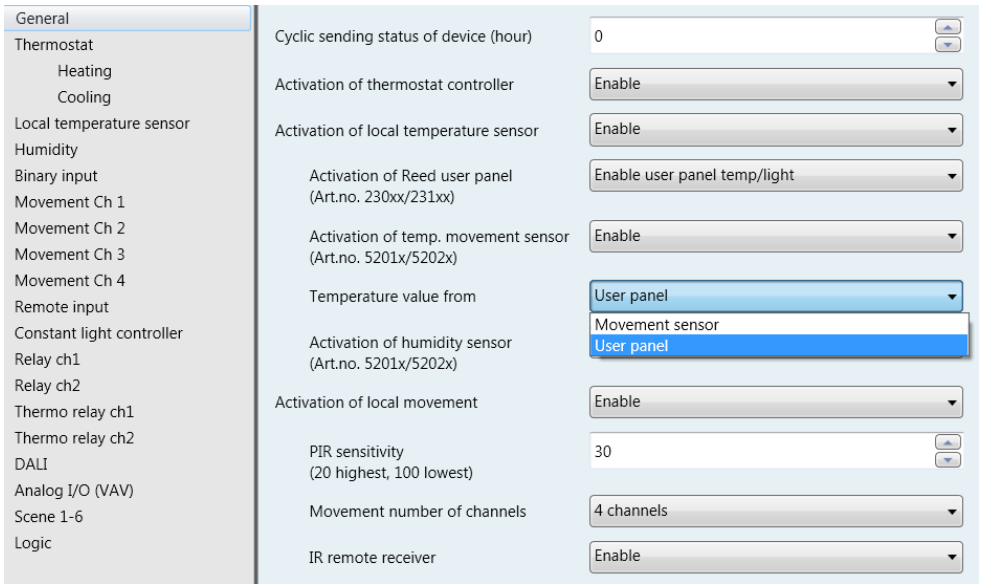


Figure 5 - Temperature value from movement sensor or user panel

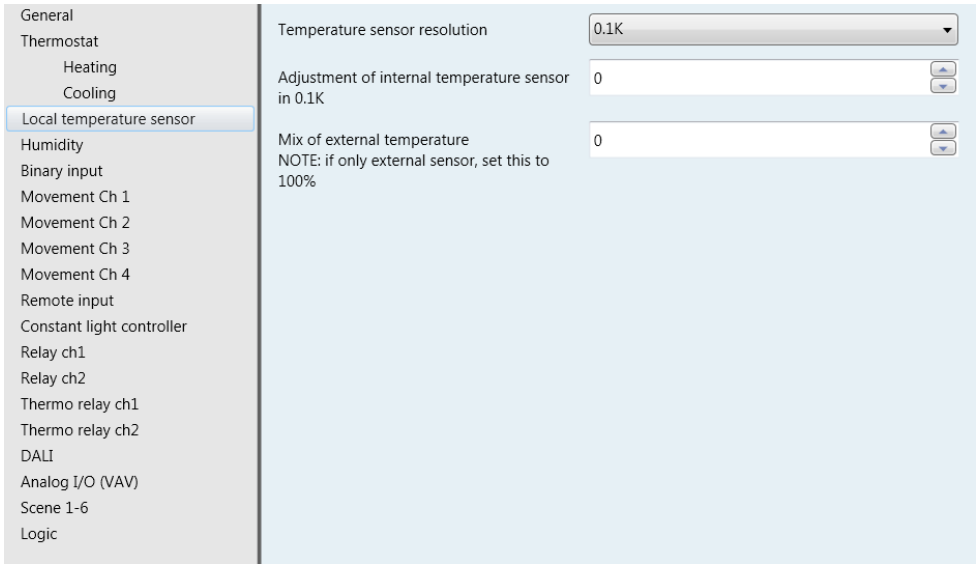


Figure 6 – Local temperature sensor parameters

Table 1 - Object list for general and user panel objects

Obj.	Object name	Description	Size, flags, DPT
0	Device: Self-Test status	This object will report self-test result and live status with a "0" if everything is ok. If it sends "1", the self-test has failed. Cyclic sending can be activated using set parameter. This object will be set high if the communication with the movement detector or user panel has failed.	1 Bit R-CT-- [1.2] DPT_Bool
1	Panel: Dimming operation - Switch	This object will be visible if parameter “Activation of user panel” is set to "temp/light". The object will be transmitted with a 1 or a 0 if the “up” or “down“ button is pressed (short operation)	1 Bit --CT-- [1.1] DPT_Switch
1	Panel: Shutter operation - Stop/Step	This object will be visible if parameter “Activation of user panel” is set to “temp/shutter”. The object will be transmitted with a 1 or a 0 if either the “up” or “down“ button is pressed (long operation).	1 Bit --CT-- [1.007] DPT_Step
2	Panel: Dimming operation - Dimming	This object will be visible if parameter “Activation of user panel” is set to "temp/light". The object will transmit a 4 bit dimming command when the “up” or “down“ button is pressed (long operation)	4 Bit --CT-- [3.7] DPT_Control_Dimming
2	Panel: Shutter operation - Up/Down	This object will be visible if parameter “Activation of user panel” is set to “temp/shutter”. The object will transmit a 1 or a 0 if either the “up” or “down“ button is pressed (long operation).	1 Bit --CT-- [1.8] DPT_UpDown
3	Panel: Block blinds operation	If enabled using set parameter, this com object will block the shutter operation objects.	1 Bit -WC--- [1.2] DPT_Bool

4 Movement sensor

The movement- and brightness sensor is connected to the KNX MultiController through regular patch cable with RJ45 connectors. The parameter “Activation of local movement” in the General tab has to be enabled before the movement channel parameter windows appear.

There are 4 channels available based on the movement detector. Each channel can be individually configured with recovery time, cyclic sending and configuration for start and end of detection (see Figure 7 for the parameter window). There is also an object for blocking the movement channel and the option to send a value at start and/or end of detection.

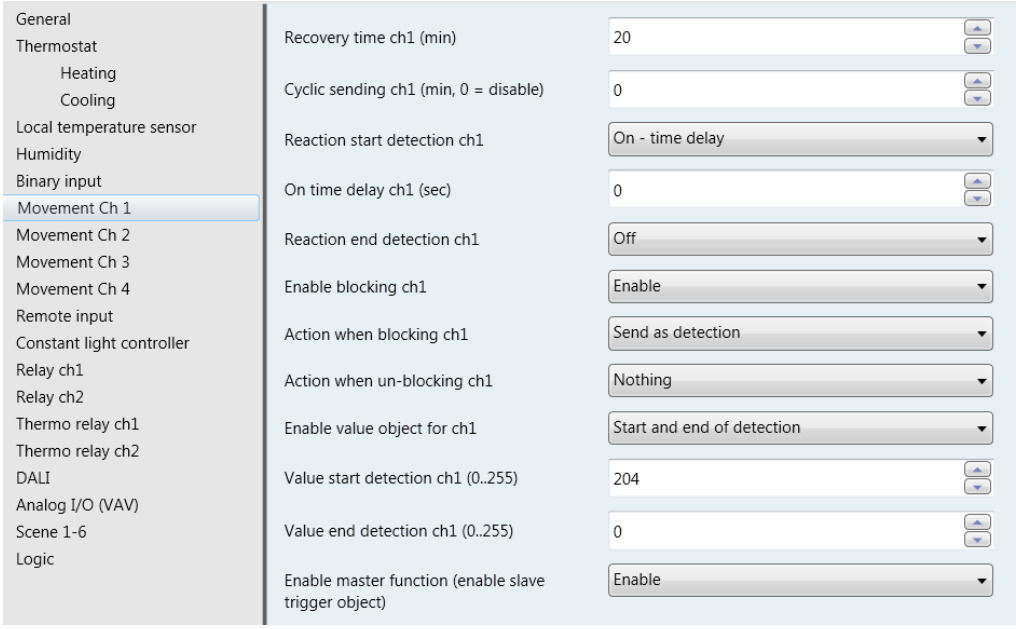


Figure 7 - Movement sensor parameter window

The movement channels can be configured individually with:

1. **Recovery time** for detection from 1 to 255 minutes. The recovery time specifies the time between the last detected movement and when the object is set low.

2. **Cyclic sending on commands** of the movement channel can be enabled or disabled. The cycle time can be between 1 and 255 minutes. Parameter value 0 disables the function.

3. **Reaction start of detection** (On, On-time delay, Off and No reaction)

4. **Reaction end of detection** (Off, On and No reaction)

5. **Enable or disable movement blocking object** (see object description)

6. **Transmit value at start and end of detection** (enables a movement value)

7. **Movement Ch. 1 can be configured as a master** (i.e. the write flag is enabled for the switch object)

The lux measurement from the movement sensor is part of the constant light controller and is read-enabled as object 43 "Const. Light Controller: Current value (lux)".

Movement ch1 switch object can be triggered externally through object 31: "Movement Ch1: Slave trigger input". The parameter Movement Ch1 "**Enable Master function (enable slave trigger object)**" has to be enabled.

4.1 Cyclic sending

If the value of cyclic sending is lower than the recovery time, the sensor will not send any cyclic on telegrams. If the two values are the same, the sensor sends one cyclic sending right before the recovery time elapses. The cyclic sending time will not be affected by a re-trigged recovery time. There will be no cyclic telegrams if the "Reaction start of detection" is set to "No reaction".

The value object will be sent cyclically if value is set to either "Start of detection" or "Start and end of detection".

Obj.	Object name	Description	Size, flags, DPT
28	Movement Ch1: Switch	This object will be transmitted if the movement detector detects movement according to the parameter setting "Reaction start detection" ("On", "Off", "No reaction"). At the end of detection (when the "Recovery time" has elapsed) the object will be transmitted according to the "Reaction end detection" ("On", "Off" or "No reaction"). The object can be set to cyclic sending depending on parameter "Cyclic sending".	1 Bit --CT-- [1.1] DPT_Switch
29	Movement Ch1: Value	Transmits a predefined value at detection and/or at the end of detection.	1 Byte --CT-- [5.1] DPT_Scaling
30	Movement Ch1: Block	The movement channel can be blocked. If this object is set to true, then neither switch nor value object based on movement will be sent.	1 Bit -WC--- [1.2] DPT_Bool
31	Movement Ch1: Slave trigger input	This object can allow external triggering of the movement detector. All movement channels will be triggered if a "1" is received. Receiving "0" will have no effect.	1 Bit -WC--- [1.1] DPT_Switch
32	Movement Ch2: Switch	This object will be transmitted if the movement detector detects movement according to the parameter setting "Reaction start detection" ("On", "Off", "No reaction"). At the end of detection (when the "Recovery time" has elapsed) the object will be transmitted according to the "Reaction end detection" ("On", "Off" or "No reaction"). The object can be set to cyclic sending depending on parameter "Cyclic sending".	1 Bit --CT-- [1.1] DPT_Switch
33	Movement Ch2: Value	Transmit predefined value at detection and/or at the end of detection.	1 Byte --CT-- [5.1] DPT_Scaling
34	Movement Ch2: Block	The movement channel can be blocked. If this object is set to true, then neither switch nor value object based on movement will be sent.	1 Bit -WC--- [1.2] DPT_Bool
35	Movement Ch3: Switch	This object will be transmitted if the movement detector detects movement according to the parameter setting "Reaction start detection" ("On", "Off", "No reaction"). At the end of detection (when the "Recovery time" has elapsed) the object will be transmitted according to the "Reaction end detection" ("On", "Off" or "No reaction").	1 Bit --CT-- [1.1] DPT_Switch

		The object can be set to cyclic sending depending on parameter “Cyclic sending”.	
36	Movement Ch3: Value	Transmit predefined value at detection and/or at the end of detection.	1 Byte --CT-- [5.1] DPT_Scaling
37	Movement Ch3: Block	The movement channel can be blocked. If this object is set to true, then no switch and value object based on movement will be sent.	1 Bit -WC--- [1.2] DPT_Bool
38	Movement Ch4: Switch	This object will be transmitted if the movement detector detects movement according to the parameter setting "Reaction start detection" (“On”, "Off", "No reaction"). At the end of detection (when the “Recovery time” has elapsed) the object will be transmitted according to the "Reaction end detection" (“On“, "Off" or "No reaction”). The object can be set to cyclic sending depending on parameter “Cyclic sending”.	1 Bit --CT-- [1.1] DPT_Switch
39	Movement Ch4: Value	Transmit predefined value at detection and/or at the end of detection.	1 Byte --CT-- [5.1] DPT_Scaling
40	Movement Ch4: Block	The movement channel can be blocked. If this object is set to true, then neither switch nor value object based on movement will be sent.	1 Bit -WC--- [1.2] DPT_Bool

5 Constant light controller

The constant light controller is either using the lux level measurement from the movement sensor or from an external lux sensor by KNX object. The output dimming value of the constant light controller can either be available as KNX object for external linking or directly linked to the internal DALI interface.

The constant light controller changes the dimming value depending on the "step size in %" and "step size in seconds". The default value of 3% dim value change in 5 second steps should fit most lighting systems. If long delay is expected from dim value update to actual change in light level, then lower the step size in % or increase the step size in seconds.

See Figure 8 for the parameter window for the constant light controller.

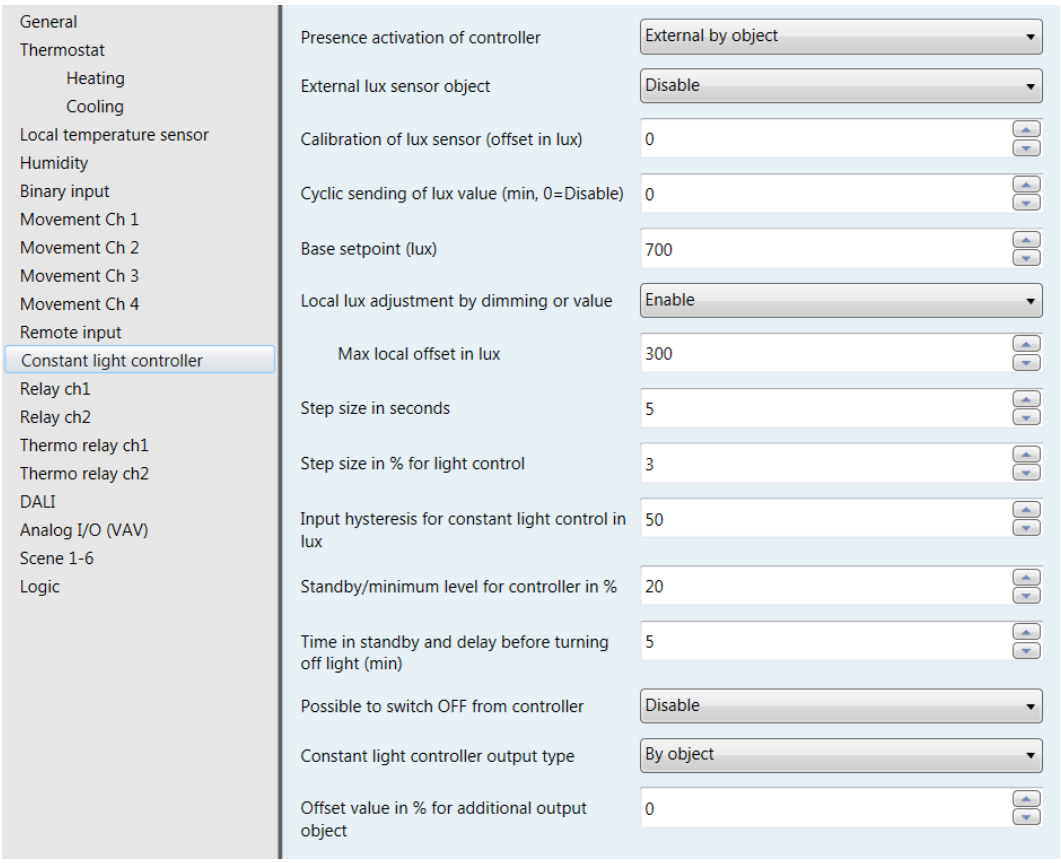


Figure 8 – Constant light controller parameter window

5.1 Constant light controller output

The output will not change as long as the current lux level is within the "input hysteresis for constant light control" which is default at 50 lux. This means that the output will be changed +3% if the measured value is lower than 650 lux and -3% if it is higher than 750 lux for a set point of 700 lux.

The output from the constant light controller can be set via parameter to:

- Communication object ("By object")
- DALI interface group 0 ("DALI Group 0")
- DALI interface group 0 and 1 ("DALI Group 0 and 1")
- DALI interface Broadcast ("DALI Broadcast")

If the output of the constant light controller is configured as "by object" then the DALI groups you wish to be constant light controlled must be linked manually by group addresses.

If the output of the constant light controller is configured as "DALI broadcast", then all connected DALI lamps will follow the output value from the constant light controller.

5.1.1 Output with offset

Two value objects appear when the constant light controller output type is set to "By object"; the output value object and the value object with offset (object 50 and 51). The output value with offset can control a group of lamps with a 0 to 50% higher dimming value than the main group of lamps. Typically the main group of lamps would be closest to the façade, and the group of lamps controlled with the output value with offset would be the lamps furthest away from the façade.

The option to have offset between two DALI groups is also possible when "DALI Group 0 and 1" is the chosen output from the constant light controller. For example, in a classroom the row of lights closest to the windows (DALI Group 0) will be dimmed down and the row of lamps farthest away from the windows (DALI Group 1) will have a higher dimming value based on the offset parameter.

5.2 Minimum dimming level and turn-off

The minimum dimming level can be set to a value in per cent to prevent low dimming values. The parameter "Standby/minimum level for controller in %" will both act as this minimum dimming level as well as the standby dim level after the presence object (or internal sensor) has been switched off. The parameter "Time in standby and delay before turning off" will determine when the lamp will be turned off.

It can be unpleasant for the occupants to experience constant light control where the lamp is turned completely off. It is therefore possible to set a minimum dimming level, time delay at minimum level and disabling of turn-off from the constant light regulator.

5.3 Activation of constant light controller

The constant light controller can be activated either by communication object or by "Movement Ch. 1" (can be set via the parameter "Presence activation of controller").

The controller can be disabled by linking one or more of the three disable objects (object 46-48). The constant light controller will be disabled until the presence activation (object 41) or internal movement ch1 is set to false.

It is possible to re-configure the "disable objects" to work as set point changers. When the "Local lux adjustment by dimming or value" parameter is set, and object 47-48 is written to, the constant light regulator will record the new LUX level after about 20 seconds. The recorded lux level will be the new actual lux set point (obj. 45: "Actual set point (lux)"). The new actual set point is stored until the device has lost bus power.

Note that objects 47-48 will not change the light level, only tell the constant light regulator to record the present lux measurement as the actual set point. External linking must be done to change the light level (link with Dali dim or value objects).

5.4 Re-activate the light controller

The constant light controller can be re-activated after controlling the light manually ether by switching off and on object 41 or by pressing the "Eco" button on the infrared remote control.

5.4.1 Lux calibration

The lux level object, "Const. Light Controller: Current value (lux)", can be calibrated by writing to the object. The calibration factor is calculated as the written lux value divided by the raw lux value. The calibration factor is stored permanently in EEPROM/flash.

Both raw values and the resulting calibrated values are shown in Figure 9. The pink line is the raw value (V) from the sensor; the blue line is the wanted value (W) set by the user. The calibration factor is the ratio between the wanted lux value and the raw lux value: C=W/V

If the raw value V=1000, and the object is updated with 800, then the calibration factor will be: C=800/1000=0.8. See the graph in Figure 9.

The formula for calculating the calibrated lux value is: Lux=C*V

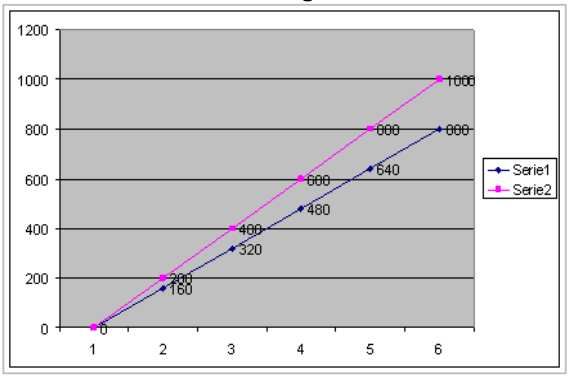


Figure 9 - Raw and calibrated lux values

The calibration factor is set to 1 and the raw value is used if "0" is written to the "Current value (lux)" object. The object should be set to 0 to clear the current calibration before re-calibrating the lux level. The lux level calibration is limited to 2 times the raw lux level, so if, for example, the raw lux level is 1000, the calibration is limited to 2000 (calibration factor <=2).

5.5 Object list

Table 2 - Object list for the constant light controller

Obj.	Object name	Description	Size, flags, DPT
41	Const. Light Controller: Presence/activation	This object will activate or de-activate the constant light controller. The object is only available if the "Presence activation of controller" is set to "External by object".	1 Bit -WC--- [1.1] DPT_Switch
42	Const. Light Controller: Status	Shows the status of the constant light controller (True: controller is active, False: controller is inactive)	1 Bit R-CT-- [1.2] DPT_Bool
43	Controller: Current value (lux)	The current lux value from the lux sensor. Writing a lux value to this object will calibrate the lux level measurement.	2 Bytes RWCT-- [9.4] DPT_Value_Lux
43	Controller: External value (lux)	The value from an external lux sensor.	2 Bytes -WCT-- [9.4] DPT_Value_Lux
44	Controller: Base setpoint (lux)	Base setpoint for the constant light controller. The value will be reset to the parameter value at power on or reset.	2 Bytes RWCT-- [9.4] DPT_Value_Lux
45	Controller: Actual setpoint (lux)	The actual setpoint for the constant light controller. The object is only available if "Local lux adjustment by dimming or value" is enabled. This object will be reset if the base setpoint (object 44) is changed.	2 Bytes R-CT-- [9.4] DPT_Value_Lux
46	Controller: Disable - Switch	The constant light controller can be disabled by sending "True" or "False" to this object. The light can then be turned On or Off by DALI broadcast or DALI group objects. The constant light regulator will be re-enabled if the presence object or internal movement ch1 goes to "False" and then to "True" again (regardless of whether the regulator is in stand-by).	1 Bit -WC--- [1.1] DPT_Switch
47	Controller: Disable - Dimming	The constant light controller can be disabled by sending a dimming telegram to this object. The constant light controller will be disabled until the presence object (41) or internal movement ch1 times out and the light turns off. The object is only available if "Local lux adjustment by dimming or value" is disabled.	4 Bit -WC--- [3.7] DPT_Control_Dimming
47	Controller: Record Level - Dimming	This object must be linked with the DALI dimming object. When the light is dimmed, the new lux level will be recorded by the constant light controller and used as the actual setpoint (object 45). The object is only available if "Local lux adjustment by dimming or value" is enabled.	4 Bit -WC--- [3.7] DPT_Control_Dimming

48	Controller: Record Level - Value	This object must be linked with the DALI value object. When the light is dimmed by a new value, the new lux level will be recorded by the constant light controller and used as the actual setpoint (object 45). The object is only available if "Local lux adjustment by dimming or value" is enabled.	1 Byte -WC--- [5.1] DPT_Scaling
48	Controller: Disable - Value	The constant light controller can be disabled by sending a value telegram to this object. The constant light controller will be disabled until the presence object (41) or internal movement ch1 times out and the light turns off. The object is only available if "Local lux adjustment by dimming or value" is disabled.	1 Byte -WC--- [5.1] DPT_Scaling
49	Controller: Output - Switch	Available if "Constant light controller output type" is set to "By object". This object will transmit "1" if the output of the constant light controller is on or "0" if it is off.	1 Bit R-CT-- [1.1] DPT_Switch
50	Controller: Output - Value	Available if the parameter "Constant light controller output type" is set to "By object". This object will transmit the output dim value from the constant light controller.	1 Byte R-CT-- [5.1] DPT_Scaling
51	Controller: Output - Value with offset	Available if the parameter "Constant light controller output type" is set to "By object". This object will transmit the output dim value from object 50 plus the offset % value given in parameter.	1 Byte R-CT-- [5.1] DPT_Scaling

6 Infrared remote

The movement sensor comes with an infrared remote receiver, which can be enabled in the General parameter window (see Figure 4).

The remote has two sets of up/down buttons for remote input 1 and 2 that can be configured as switch, dimming, shutter/blinds or value for scene control. Remote input 1 will respond to the up/down buttons for light, and remote input 2 for the blinds buttons.

The remote has 7 buttons for temperature set-point adjustment, allowing set-point change from +3 to -3 °C (linked to Object 8: "Thermostat: Local adjustment of temp offset").

The ECO mode button will set the local adjustment of temp offset to 0 and also re-enable the constant light regulator, if the regulator has been disabled by manual light control.

Example:
The up and down button for light can send switch (1 bit) and dim (4 bit) objects to the bus that can be linked with the appropriate DALI or mechanical relay objects.
Alternatively, the buttons can be configured to send a scene value that can be linked with the scene controller. The scene controller will recall the pre-defined dimming values for the 4 DALI groups.

Table 3 - Object list for the infrared remote control

Obj.	Object name	Description	Size, flags, DPT
134	Remote input 1: Dimming operation - Switch	This object appears if the remote input 1 is set to “Dimming”. This object will transmit on or off if the up or down button on the remote is pressed	1 Bit --CT-- [1.1] DPT_Switch
134	Remote input 1: Shutter operation - Stop/Step	This object appears if the remote input 1 is set to “Shutter”. This object is transmitted (stop/step) if the up or down button on the remote is pressed.	1 Bit --CT-- [1.007] DPT_Step
134	Remote input 1: Switch	This object appears if the remote input 1 is set to “Switching”. The object is transmitted if the up or down button on the remote is pressed.	1 Bit --CT-- [1.1] DPT_Switch
135	Remote input 1: Shutter operation - Up/Down	This object appears if the remote input 1 is set to “Shutter”. The object is transmitted if the up or down button is pressed and held down.	1 Bit --CT-- [1.8] DPT_UpDown
135	Remote input 1: Dimming operation - Dimming	This object appears if the remote input 1 is set to “Dimming”. This object will transmit dim up or dim down if the up or down button on the remote is pressed and held down	4 Bit --CT-- [3.7] DPT_Control_Dimming
135	Remote input 1: Transmit value	This object appears if the remote input 1 is set to “Value (Scene)”. This object will transmit the specified value for the up or down button (0..255).	1 Byte --CT-- [5.10] DPT_Control_Dimming
136	Remote input 2: Shutter operation - Stop/Step	This object appears if the remote input 2 is set to “Shutter”. This object is transmitted (stop/step) if the up or down button on the remote is pressed.	1 Bit --CT-- [1.007] DPT_Step
136	Remote input 2: Dimming operation - Switch	This object appears if the remote input 2 is set to “Dimming”. This object will transmit on or off if the up or down button on the remote is pressed	1 Bit --CT-- [1.1] DPT_Switch
136	Remote input 2: Switch	This object appears if the remote input 2 is set to “Switching”. The object is transmitted if the up or down button on the remote is pressed.	1 Bit --CT-- [1.1] DPT_Switch
137	Remote input 2: Shutter operation - Up/Down	This object appears if the remote input 2 is set to “Shutter”. The object is transmitted if the up or down button is pressed and held down.	1 Bit --CT-- [1.8] DPT_UpDown
137	Remote input 2: Dimming operation - Dimming	This object appears if the remote input 2 is set to “Dimming”. This object will transmit dim up or dim down if the up or down button on the remote is pressed and held down	4 Bit --CT-- [3.7] DPT_Control_Dimming
137	Remote input 2: Transmit value	This object appears if the remote input 2 is set to “Value (Scene)”. This object will transmit the specified value for the up or down button (0..255).	1 Byte --CT-- [5.10] DPT_Control_Dimming

7 DALI

The KNX MultiController has a built-in DALI gateway that can control up to 12 DALI control gears (EVGs). Communication with the DALI gear is done by DALI broadcast and/or DALI group 0 to 3. The broadcast mode is enabled by default, so there is no need for group assignments unless individual control is required.

It is possible to use up to four DALI groups (group 0 to 3) to control lamps. The DALI lamps must be assigned to group 0 to 3 with an external DALI programming interface or by the function DALI tool application in order to use the group addressing mode.

The DALI interface can be configured with start-up dimming value, switch On/Off permissions, dimming time, minimum- and maximum dimming values. These settings will be inherited by the DALI groups. The parameter "Duration in standby before Off in min" is only used for broadcast communication (see chapter 7.1).

DALI addressing happens after reset/power-on of the KNX MultiController, or after ETS download if enabled using set parameter. If this function is enabled, the DALI nodes without short address will be assigned a short address in the range from 0 to 12.

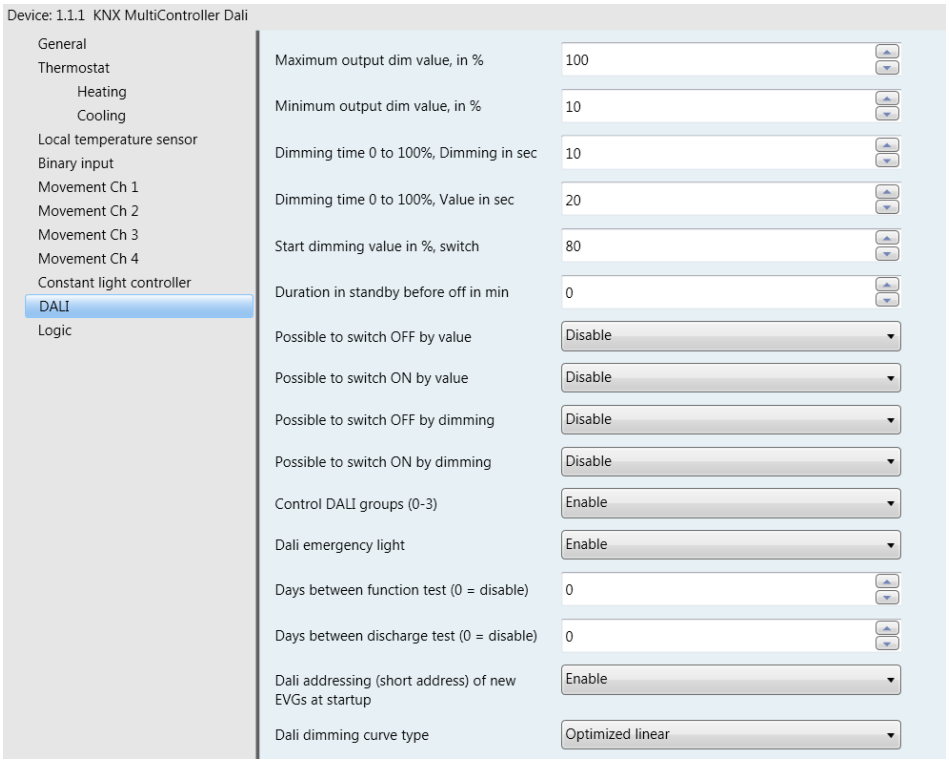


Figure 10 – DALI interface parameters

After a power failure, the DALI interface will not retain a list in its memory of attached DALI nodes, but search the DALI bus for attached DALI devices at:

- Power-on (230V)
- Start-up of the KNX node either when the KNX bus is connected or after download of an application with the ETS tool

NOTE: Recommended order of connection: connect sensor, DALI lamps and all outputs before connecting 230V and KNX power.

7.1 Dimming value and dimming time

Dimming times in seconds for maximum range dimming can be configured independently using set parameters for the 4 bit dimming object and for the 1 byte dimming value. The DALI gateway will use this time value to set an appropriate slew rate in the EVGs, based on the DALI standard fade time shown in Table 4 below.

Table 4 – Fade time enumerations according to the DALI standard

Enumeration	Fade time (s)
0	0
1	0,7
2	1
3	1,4
4	2
5	2,8
6	4
7	5,7
8	8
9	11,3
10	16
11	22,6
12	32
13	45,3
14	64
15	90,5

Example: if the dim time 0-100% is set to 20 sec and a change in dim value from 30-100% is requested (70%*20sec = 14sec), the resulting EVG fade time would be 16 sec (the closest value rounded upwards).

Minimum and maximum output values can be defined as well as the turn-on dimming value. If the turn-on dimming value is set higher than the maximum output value, the maximum output value will be used as turn-on dimming value.

It is possible to configure Turn-On and Turn-Off permissions for both the 4-bit dimming command and the 8-bit value command.

The parameter "Duration in standby before Off" should only be used for DALI broadcast. The DALI groups can be turned off instantaneously regardless of the duration in standby parameter. If the DALI gateway receives communication "Off" to object "DALI broadcast: Switch" (obj. 88), then all the lamps will be dimmed down to the minimum output dim value until the standby duration elapses. The DALI groups can be controlled during the standby duration, but will be turned off when the timer elapses.

7.2 DALI broadcast object list

Table 5 – Communication objects for the DALI interface.

Obj.	Object name	Description	Size, flags, DPT
88	DALI broadcast: Switch	The broadcast switch object for the DALI interface. This object will turn all attached DALI EVGs On or Off.	1 Bit -WC--- [1.1] DPT_Switch
89	DALI broadcast: Dimming	The broadcast dimming object for the DALI interface. This object will dim all the attached DALI EVGs based on the 4-bit dimming object.	4 Bit -WC--- [3.7] DPT_Control_Dimming
90	DALI broadcast: Value	The broadcast value object for the DALI interface. This object will dim all the attached DALI EVGs based on a 0-100% value.	1 Byte -WC--- [5.1] DPT_Scaling
91	DALI broadcast: Switch status	The broadcast switch status object will show the On/Off status of the DALI broadcast command (groups can be turned On or Off without updating this object).	1 Bit R-CT-- [1.1] DPT_Switch
92	DALI broadcast: Value status	The broadcast dimming value status object will show the dim percentage of the DALI broadcast command (groups can be dimmed without updating this object).	1 Byte R-CT-- [5.1] DPT_Scaling
93	DALI broadcast: Permanent (burn in lamps)	Permanent On command for the DALI interface. This object can be used to burn in the lamps after installation or bulb change. The lamps will be set to 100% regardless of the maximum dim value specified in parameters. The DALI group and broadcast commands are disabled when this object is set high.	1 Bit -WC--- [1.2] DPT_Bool
94	DALI broadcast: Force on	Force on command for the DALI interface. This object will force all the lamps on to the maximum dim value. The DALI group and broadcast commands are disabled when this object is set high.	1 Bit -WC--- [1.2] DPT_Bool
95	DALI broadcast: Force Off	Force Off command for the DALI interface. This object will force all the lamps off, except when in permanent mode (obj. 93). The DALI group and broadcast commands are disabled when this object is set high.	1 Bit -WC--- [1.2] DPT_Bool
98	DALI broadcast: Lamp fault	Indicates lamp or EVG failure of one or more lamps connected to the DALI interface. The status for each EVG is collected periodically with a few minutes delay.	1 Bit R-CT-- [1.2] DPT_Bool

7.3 DALI dimming curve types

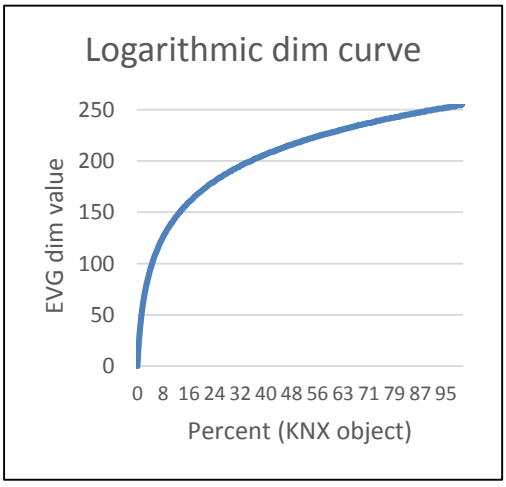
The DALI interface can be configured to use one of three dimming curve types: raw, logarithmic and optimised linear.

The **raw value dimming curve** will do no modification of the requested object dim value except that the value 255 will be set to 254 to avoid the DALI EVGs masking the dimming request (see the DALI standard).

The **logarithmic dimming curve** will calculate the DALI dim value from the requested per cent value as shown in Table 6. If 50% dimming is requested by KNX object, the DALI interface will set the EVG dim value to 218.

Table 6 Logarithmic dim curve

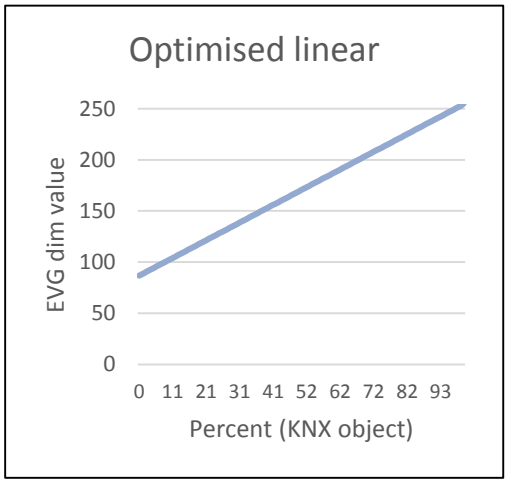
Per cent (KNX)	Byte value (KNX)	Dim value (DALI)
5,1	13	102
10,2	26	137
15	38	156
20,1	51	171
25,2	64	183
30,3	77	192
35	89	200
39,8	101	206
44,9	114	213
50	127	218
55,1	140	224
60,2	153	228
65	165	232
70,1	178	236
75,2	191	240
80,3	204	243
85	216	246
90,2	229	249
94,9	241	252
100	254	254



The **Optimised linear dimming curve** will linearize the DALI dim values as shown in Table 7. The EVGs do not usually respond to dim values below 85. The optimised linear dim curve will start at 85 and progress through to 254 as the highest value. The DALI dim value will be set to 171 if 50% dim value is requested by the KNX object.

Table 7 Optimised linear dim curve

Per cent (KNX)	Byte value (KNX)	Dim value (DALI)
5,1	13	95
10,2	26	103
15	38	111
20,1	51	120
25,2	64	129
30,3	77	137
35	89	145
39,8	101	153
44,9	114	162
50	127	171
55,1	140	179
60,2	153	188
65	165	196
70,1	178	204
75,2	191	213
80,3	204	222
85	216	230
90,2	229	238
94,9	241	246
100	254	254



7.4 DALI group objects

EVGs with group addresses from 0 to 3 can be controlled by KNX switch, dimming and value objects. The DALI groups will have the same maximum, minimum, On/Off permissions and turn-on dim settings as DALI Broadcast (see Figure 10).

DALI broadcast commands for switch, dim, value, permanent and force On/Off will override the group commands. In regular mode where permanent, force on and force off are disabled, the objects for the DALI groups will control the lamps.

The constant light controller (see chapter 0) can also control either DALI broadcast or the DALI group 0 and 1. If the constant light controller is enabled and individual control of light is also needed, be sure to link the appropriate constant light controller "disable" object.

Example – Combined constant light control and control by groups:
The KNX MultiController can control DALI lamps by broadcast commands or pre-defined DALI groups. For a meeting room with 4 suspended luminaires and 4 spotlights, it is best to assign groups. For this example, the two suspended luminaires closest to the windows should be assigned to group 0 and the two farthest from the windows to group 1. The four spotlights can be assigned to group 2 and 3.
The four ceiling suspended luminaries can operate in constant light regulation mode, based on the movement and lux detector, where the two groups can have dimming offset to account for reduced need of lighting closest to the windows.
For special lighting needs the constant light regulator can be disabled and the 4 DALI groups can be controlled individually, for example the suspended luminaires can be set to 20%, and the spotlights set to 90%.

Table 8 – Communication objects for the DALI groups.

Obj.	Object name	Description	Size, flags, DPT
99	DALI group 0: Switch	The DALI group switch object. This object will turn the attached DALI EVGs assigned to group 0 On or Off.	1 Bit -WC--- [1.1] DPT_Switch
100	DALI group 0: Dimming	The DALI group dimming object. This object will dim the attached DALI EVGs assigned to group 0.	4 Bit -WC--- [3.7] DPT_Control_Dimming
101	DALI group 0: Value	The DALI group value object. This object will dim the attached DALI EVGs assigned to group 0 to the given value in per cent.	1 Byte -WC--- [5.1] DPT_Scaling
102	DALI group 0: Switch status	The DALI group switch status object will show the On/Off status of the DALI EVGs assigned to group 0.	1 Bit R-CT-- [1.1] DPT_Switch
103	DALI group 0: Value status	The DALI group dimming value status object will show the dim percentage of the DALI EVGs assigned to group 0.	1 Byte R-CT-- [5.1] DPT_Scaling
104	DALI group 1: Switch	The DALI group switch object. This object will turn the attached DALI EVGs assigned to group 1 On or Off.	1 Bit -WC--- [1.1] DPT_Switch

105	DALI group 1: Dimming	The DALI group dimming object. This object will dim the attached DALI EVGs assigned to group 1.	4 Bit -WC--- [3.7] DPT_Control_Dimming
106	DALI group 1: Value	The DALI group value object. This object will dim the attached DALI EVGs assigned to group 1 to the given value in per cent.	1 Byte -WC--- [5.1] DPT_Scaling
107	DALI group 1: Switch status	The DALI group switch status object will show the On/Off status of the DALI EVGs assigned to group 1.	1 Bit R-CT-- [1.1] DPT_Switch
108	DALI group 1: Value status	The DALI group dimming value status object will show the dim percentage of the DALI EVGs assigned to group 1.	1 Byte R-CT-- [5.1] DPT_Scaling
109	DALI group 2: Switch	The DALI group switch object. This object will turn the attached DALI EVGs assigned to group 2 On or Off.	1 Bit -WC--- [1.1] DPT_Switch
110	DALI group 2: Dimming	The DALI group dimming object. This object will dim the attached DALI EVGs assigned to group 2.	4 Bit -WC--- [3.7] DPT_Control_Dimming
111	DALI group 2: Value	The DALI group value object. This object will dim the attached DALI EVGs assigned to group 2 to the given value in per cent.	1 Byte -WC--- [5.1] DPT_Scaling
112	DALI group 2: Switch status	The DALI group switch status object will show the On/Off status of the DALI EVGs assigned to group 2.	1 Bit R-CT-- [1.1] DPT_Switch
113	DALI group 2: Value status	The DALI group dimming value status object will show the dim percentage of the DALI EVGs assigned to group 2.	1 Byte R-CT-- [5.1] DPT_Scaling
114	DALI group 3: Switch	The DALI group switch object. This object will turn the attached DALI EVGs assigned to group 3 On or Off.	1 Bit -WC--- [1.1] DPT_Switch
115	DALI group 3: Dimming	The DALI group dimming object. This object will dim the attached DALI EVGs assigned to group 3.	4 Bit -WC--- [3.7] DPT_Control_Dimming
116	DALI group 3: Value	The DALI group value object. This object will dim the attached DALI EVGs assigned to group 3 to the given value in per cent.	1 Byte -WC--- [5.1] DPT_Scaling
117	DALI group 3: Switch status	The DALI group switch status object will show the On/Off status of the DALI EVGs assigned to group 3.	1 Bit R-CT-- [1.1] DPT_Switch
118	DALI group 3: Value status	The DALI group dimming value status object will show the dim percentage of the DALI EVGs assigned to group 3.	1 Byte R-CT-- [5.1] DPT_Scaling

7.5 DALI emergency light

Emergency light functionality for checking the status of the emergency lights is activated by enabling the parameter "DALI emergency light" (see Figure 10). The emergency light functionality includes:

- Manual start and stop of "emergency function" test and "emergency duration" test
- Automatic function- and discharge testing
- Objects for mode-, status- and fault indication
- Battery charge in per cent
- Measurement of duration test in minutes

The status of the DALI emergency lights will be updated every 2 minutes. Battery discharge data and test duration will be updated as long as all the connected emergency lamps can supply this data. If more than one emergency lamp is connected to the KNX MultiController, the lowest battery charge and test duration will be shown. The mode, status and failure objects will show the combined information from the connected emergency lamps.

Emergency lamps that can be turned On or Off will respond to the DALI Broadcast command. In this case, the broadcast command should not be used and the DALI emergency lamps should be assigned to DALI group 3. The regular DALI lamps should be assigned to group 0-2 as required.

7.5.1 DALI Emergency object list

Table 9 – Communication objects for the DALI Emergency function

Obj.	Object name	Description	Size, flags, DPT
119	DALI emergency: Command	Start or stop emergency light tests (function or duration) based on the given number value. The running test will be aborted before the new test is started. 0 = Stop Test 1 = Start Function Test 2 = Start partial duration Test 3 = Start duration Test 4 = Start Query Battery	1 Byte -WC--- [5.10] DPT_Value_1_Ucount
120	DALI emergency: Fault status	Indication of emergency lighting fault. This object is 1 if any of the DALI object "Emergency failure" (obj. 125) bits are set.	1 Bit R-CT-- [1.2] DPT_Bool
121	DALI emergency: Duration of last test (min)	Duration of the last successful battery test in minutes.	2 Bytes R-CT-- [7.006] DPT_TimePeriodMinH

122	DALI emergency: Battery charge (%)	This object shows the battery charge in per cent. The battery charge value is set to 255 (DALI mask value) if the emergency lamp cannot give the battery charge data. The value 254 is 100% battery charge according to the DALI battery charge	1 Byte R-CT-- [5.1] DPT_Scaling
123	DALI emergency: Emergency status	Shows the DALI emergency status (response to DALI command 253) for the attached emergency gear. Bit 0: Inhibit mode (0 = No) Bit 1: Function test done and result valid (0 = No) Bit 2: Duration test done and result valid (0 = No) Bit 3: Battery fully charged (0 = In progress) Bit 4: Function test request pending (0 = No) Bit 5: Duration test request pending (0 = No) Bit 6: Identification active (0 = No) Bit 7: Physically selected (0 = No)	1 Byte R-CT--
124	DALI emergency: Emergency mode	Shows the DALI emergency mode (response to DALI command 250) for the attached emergency gear. Bit 0: Rest mode active (0 = No) Bit 1: Normal mode active (0 = No) Bit 2: Emergency mode active (0 = No) Bit 3: Extended emergency mode active (0 = No) Bit 4: Function test is in progress; (0 = No) Bit 5: Duration test is in progress (0 = No) Bit 6: Hardwired inhibit is active (0 = Not active) Bit 7: Hardwired switch is on (0 = Off)	1 Byte R-CT--
125	DALI emergency: Emergency failure	Shows the DALI emergency failure status (response to DALI command 252) for the attached emergency gear. Bit 0: Circuit failure (0 = No) Bit 1: Battery duration failure (0 = No) Bit 2: Battery failure (0 = No) Bit 3: Emergency lamp failure (0 = No) Bit 4: Function test max. delay exceeded (0 = No) Bit 5: Duration test max. delay exceeded (0 = No) Bit 6: Function test failed (0 = No) Bit 7: Duration test failed (0 = No)	1 Byte R-CT--

8 Thermostat

8.1 Regulator functionality

The thermostat can control both heating- and cooling systems either by automatic switching between heating and cooling mode or by object. The regulator outputs can be configured either as On/Off control or continuous (0-100%) based on PI regulators.

Regulator capability:

- Four modes of operation: comfort, standby, night and frost/heat protection
- On/Off or 0-100% control for heating and cooling system
- Combined heating- and cooling regulator with automatic or manual switch-over
- Additional heating or cooling stage either with On/Off or PI control
- Automatic transmission of the regulator outputs on sensing changes, or cyclically every 40 minutes
- Room temperature measurement from the user panel or movement sensor
- The temperature sensor can be calibrated (+/- 12.6K) in steps of 0.1 K with ETS parameter
- The temperature sensor can be internally calibrated (+/-1.5K) from the user panel
- The actual temperature and the setpoint temperature can be sent to the bus on sensing changes or cyclically
- Feedback from the regulator if heating or cooling mode is active

Setpoint values:

- The base temperature setpoint is defined in parameter ("Base setpoint in ºC") and is shown by object "Thermostat: Base setpoint". This object can also be configured for write access (may select to be stored in permanent memory or not)
- The working regulator setpoint is shown by the object "Thermostat – Actual setpoint"
- The base setpoint can only be set to whole degrees (e.g. 21 or 22 °C)
- Parameters for heating and cooling temperature setpoints for standby and night mode
- Setpoints for the additional heating/cooling switching stage are derived from the values from the basic stage with an additional stage offset
- Additional heating- and cooling PI-regulators can be activated based on the PI-regulator output values of basic heating- and cooling
- Setpoint value shifting (local adjustment +/-3K) by local operation on the user panel or by object. The step size is 0.5K
- The reduced or increased temperatures for standby and night mode are adjustable in steps of 0.1K
- Frost/heat protection: frost protection set to 10 ºC (not adjustable) and heat protection set to 35 ºC (not adjustable)

8.2 Operational modes

The KNX MultiController has 4 operational modes; Comfort, Standby, Night and Frost/heat protection. The active mode is either selected based on the three 1-bit objects "Comfort Mode", "Night Mode" and "Frost/heat protection" or based on the "Thermostat: Operation mode HVAC". The table below shows which mode is active, based on the status of these three objects (X = not applicable).

Table 10 – Resulting regulator modes

	Comfort Mode (obj. 10)	Night Mode (obj. 11)	Frost/ heat (obj. 12)	Operation mode object value (obj. 13)
Comfort Mode	1	X	0	1
Standby	0	0	0	2
Night Mode	0	1	0	3
Frost/heat protect	X	X	1	4

8.3 Parameters

8.3.1 Comfort mode

The thermostat is using the "Base setpoint in ºC" as the regulator setpoint for the heating regulator in comfort mode. The heating regulator starts to heat if the actual temperature falls below the base setpoint minus the parameter value for "Low hysteresis in 0.1K".

The heating regulator will turn the heat off when the actual temperature rises above the base setpoint. The regulator will turn the heat off at 21.0 ºC with the parameter settings shown in Figure 11.

The cooling system will turn on at the temperature "Base setpoint in ºC" + "Dead zone between heating and cooling in 0.1K" + "High hysteresis in 0.1K". The cooling system will be turned off when the temperature falls below the base setpoint + dead zone. The cooling system will be turned off at 21.0 + 2.0 = 23ºC with the parameter settings shown in Figure 11.

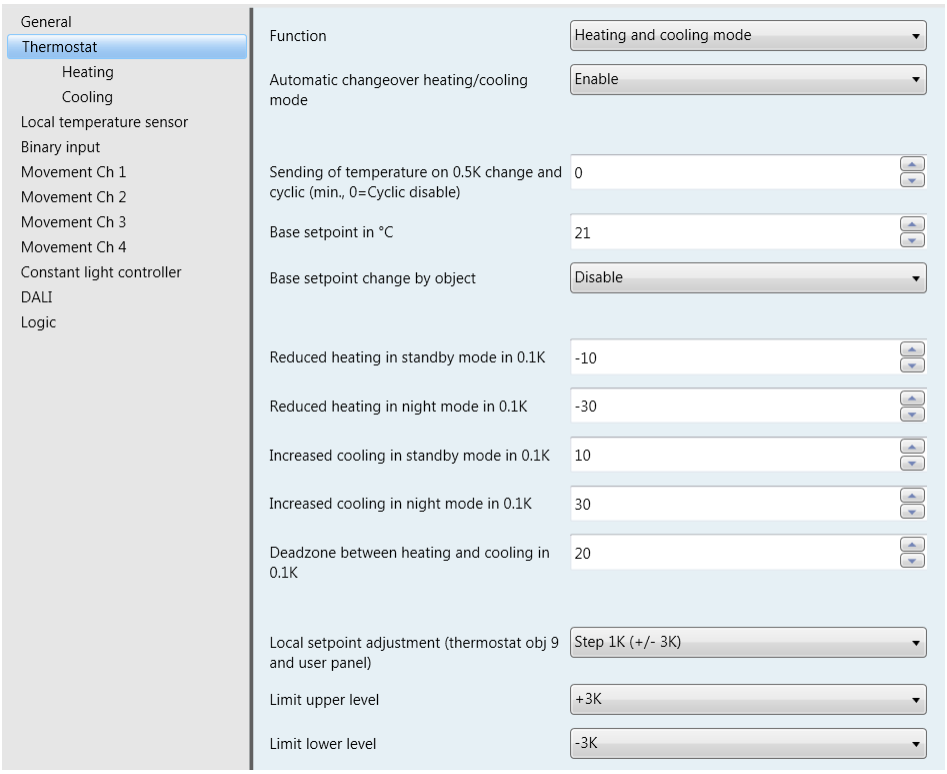


Figure 11 - Thermostat settings

The regulator uses the value from the object "Actual setpoint" as the temperature setpoint. The "Actual setpoint" will change depending on the "Base setpoint", the active mode (if the regulator is in heating- or cooling mode) and the local temperature adjustment.

8.3.2 Standby mode

The regulator goes to standby mode if the three communication objects "Comfort Mode", "Night Mode" and "Frost/heat protect" are low. The "Actual setpoint" in this mode will be set to "Base setpoint" + "Reduced Heating in standby mode". The "Actual setpoint" is set to: 21ºC + (-1.0ºC) = 20ºC for the parameter settings shown in Figure 11.

The "Actual setpoint" for the cooling system is set 1 degree higher in standby mode than in comfort mode: 21ºC + 2ºC + 1ºC = 24ºC.

The user panel LED indication for the local temperature adjustment and the green comfort mode indicator on the movement detector will be turned off when the regulator goes into standby mode. The LED indication for the active heating- and cooling system will still be active.

8.3.3 Night mode

The regulator will go to night mode if the "Night Mode" object is set high. The temperature setpoint for the heating and cooling systems will change according to the parameters "Reduced Heating in Night mode" and "Increased cooling in Night mode". The "Actual setpoint" is set to: 21ºC + (-3.0ºC) = 18ºC with the parameters shown in Figure 11 for the heating system. For the cooling system the "Actual setpoint" will be: 21ºC + 2ºC + 3ºC = 26ºC

The user panel LED indication for the local temperature adjustment and the green comfort mode indicator on the movement detector will be turned off when the regulator goes into night mode. The LED indication for the active heating- and cooling system will still be active.

8.3.4 Frost/Heat protection

The Frost/Heat protection regulator mode will set fixed temperature setpoints for the heating and cooling regulators. The heating system is turned on if the temperature falls below 10ºC – 0.5ºC hysteresis. The heating system is turned off if the temperature rises above 10ºC.
The cooling system will turn on if the temperature rises above 35ºC + 0.5ºC hysteresis and will turn off again when the temperature falls below 35ºC.

The user panel LED indication for the local temperature adjustment and the green comfort mode indicator on the movement detector will be turned off when the regulator goes into Frost/heat protection mode. The LED indication for the heating- and cooling system alternates between heating and cooling every second.

8.3.5 Basic heating and cooling stage

See the description of the different regulator modes in sections 8.3.1 to 8.3.4.

8.3.6 Additional heating and cooling stage

The KNX MultiController can control an additional heating and/or cooling system with On/Off or continuous PI control. The temperature limits for the additional heating- and cooling systems can be defined using set parameters, see Figure 12 and Figure 13.

The additional heating stage switch output will be turned on if the room temperature has dropped 2ºC below the parameter settings in the thermostat parameter window, see Figure 11. The hysteresis for the additional heating stage is fixed to +0.5ºC.
The additional heating stage will turn on if the temperature falls below 21ºC - 2.0ºC = 19ºC and turn off at 21ºC - 2.0ºC + 0.5ºC = 19.5ºC in comfort mode according to the parameter settings shown in Figure 11 and Figure 12.

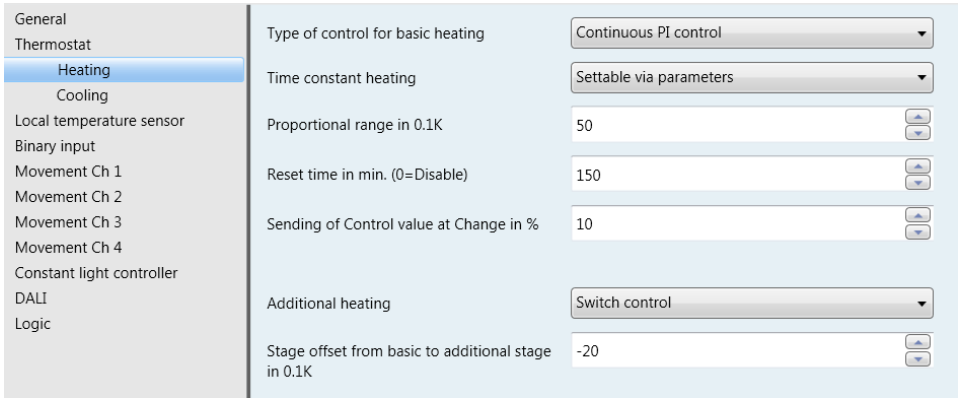


Figure 12 – Additional heating parameter windows, switch control

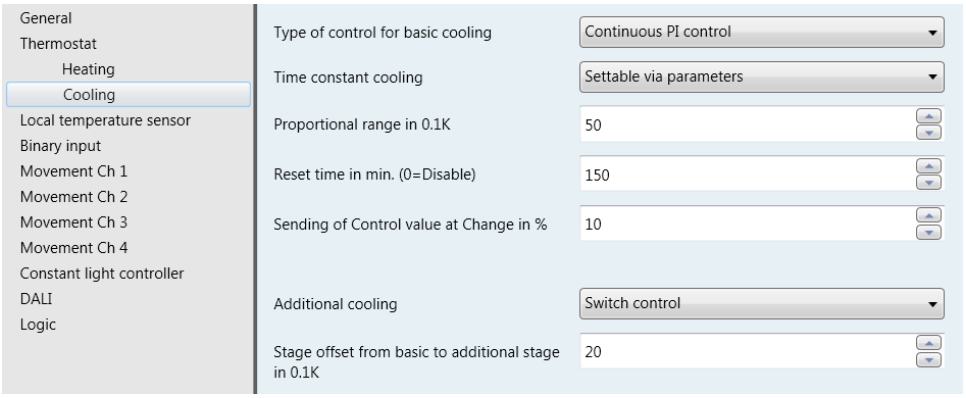


Figure 13 – Additional cooling parameter windows, switch control

The additional cooling stage switch output will be turned on based on the temperature offset parameter "Stage offset from basic to additional stage", as shown in Figure 13. The additional stage cooling will turn on if the temperature rises above 23ºC + 2.0ºC = 25ºC for comfort mode (see parameters in Figure 11). The additional stage will turn off at 23ºC + 2.0ºC - 0.5ºC = 24.5ºC

8.3.7 Additional continuous heating and cooling stage

Additional stage can be configured with continuous PI control as shown in Figure 14 and Figure 15. The additional stage output will activate when the basic stage continuous output value reaches the parameter: Threshold for activating additional heating or cooling. The setpoint for the additional stage continuous PI control is the same as the basic set-point.

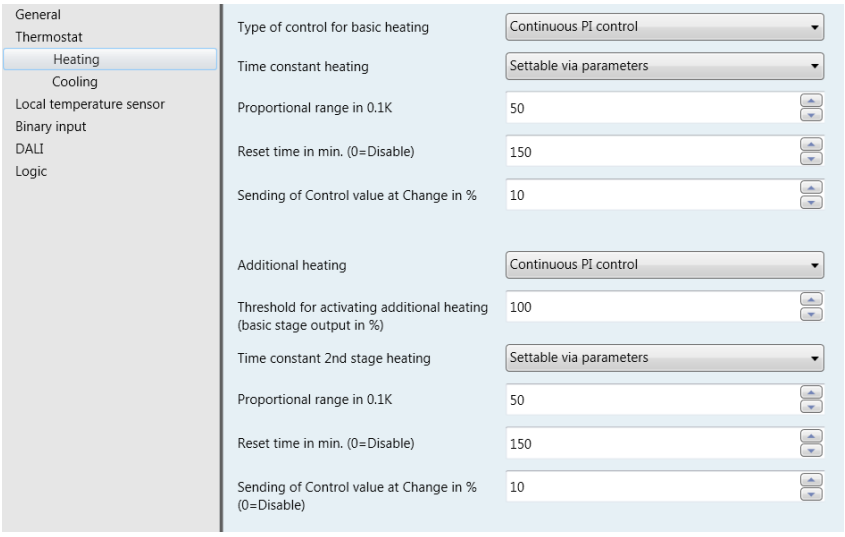


Figure 14 – Additional heating parameter windows, continuous control

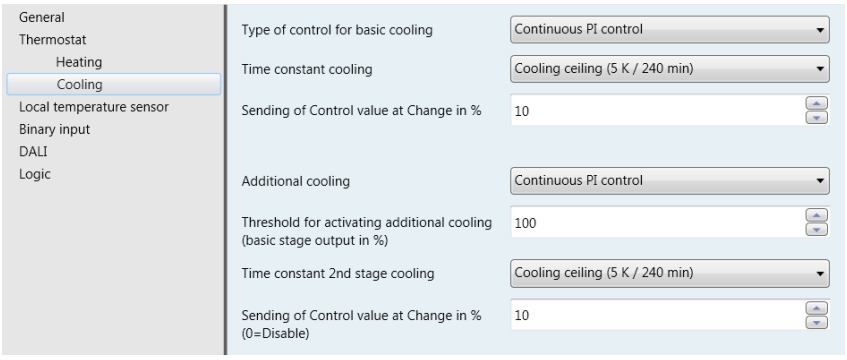


Figure 15 – Additional cooling parameter windows, continuous control

8.4 Local temperature adjustment

The temperature setpoint can be adjusted both by the communication object "Thermostat: Local adjustment of temp offset" (obj. 8), "Thermostat: Local adjustment of temp offset (step)" and via the Reed user panel (230xx and 231xx). In addition, a combination of sensor 520xx and IR Remote control 52801 allows wireless local adjustment of temperature (see chapter 6). The local adjustment object can adjust the actual temperature setpoint by +/-10ºC.

The user panel and IR remote temperature adjustment is by default +/-3ºC, but can be limited using set parameters. The adjustment done on the panel will update the "Thermostat: Local adjustment of temp offset" object.
The heating system, in comfort mode and a local adjustment of -2, will turn on at 20.5ºC - 2ºC = 18.5ºC and off at 19.0ºC with the parameters shown in Figure 11.
The cooling system will turn on at 21ºC - 2ºC + 2ºC + 0.5ºC = 21.5ºC and off if the temperature drops below 21.0ºC.

The temperature sensor in the user panel includes a filtering algorithm that will eliminate temperature rise after the user panel has been touched. The temperature measurement will remain unchanged for 3 to 8 minutes after the buttons on the user panel have been operated.

It is possible to change the upper and lower limit of the local temperature offset, for example to +3 to -1C, +1.5C to -0.5C and +0.5 to -0C. The LED indicating +3 to -3 on the user panel will still show the full scale, so the user will not notice the limitation.

If the user panel or the combined movement and temperature sensor is removed, all regulator outputs will be set to "0" one time, and the actual temperature object is set to 0ºC. The "Self-test status" object will indicate the error and will be transmitted as "1".

8.5 Regulator function

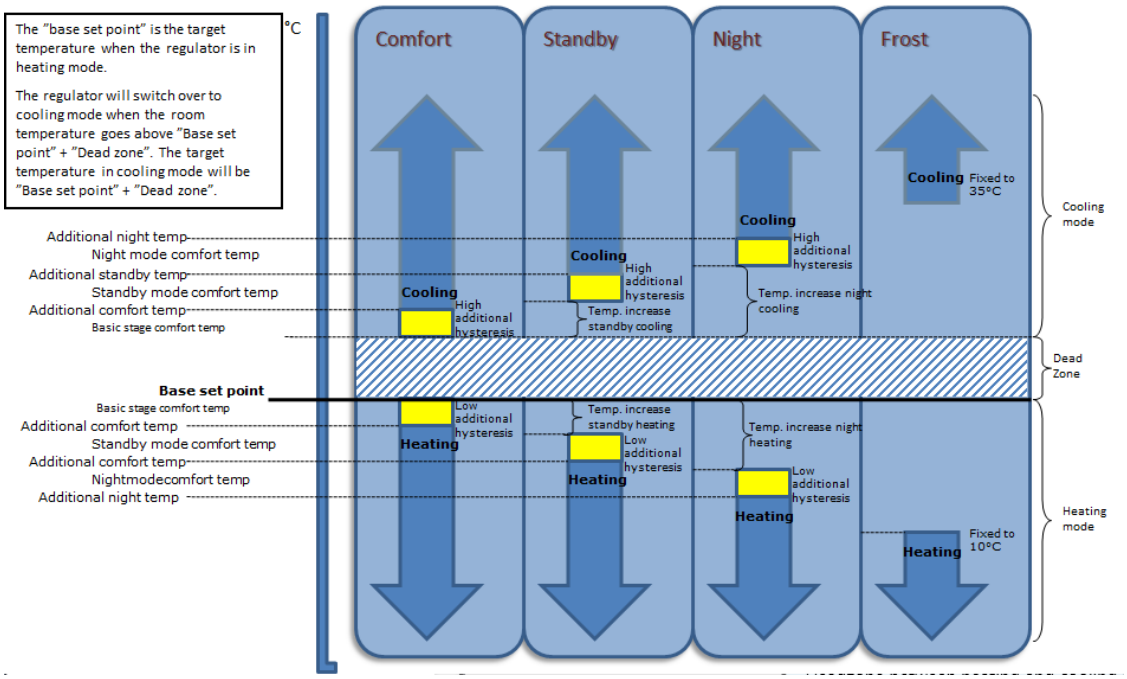


Figure 16 - Asymmetric regulator functionality

8.6 PI Regulator

The KNX MultiController thermostat can control heating and cooling systems with Pulse-Width-Modulation. The communication object for the PWM control value output is a 1-byte 0-100% of the type DPT5.001. The control value will automatically be transmitted every 40 minutes and can also be transmitted when the value has changed more than a specific percentage, see Figure 17.

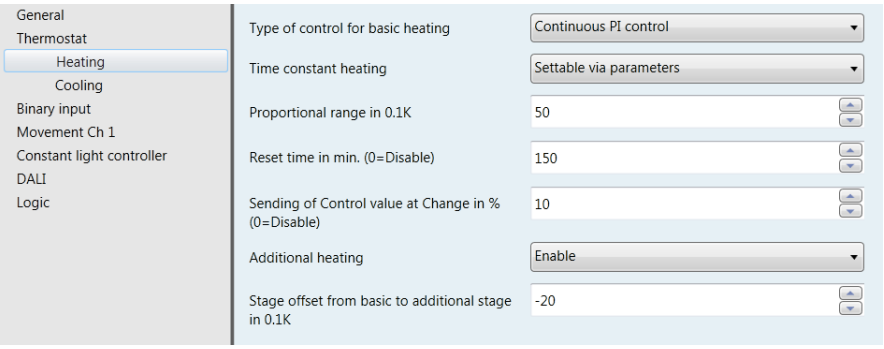


Figure 17 - Heating PI-regulator

The PI-regulator is configured with a proportional factor (K_p) and a reset time (T_i). The equation for the regulator output is shown in equation (3).

The integration of the error for each regulator evaluation is substituted by the step number (30 second increments) multiplied with the last error function: e(n)·n divided by the time constant, see equation (3)

The proportional factor K_p :

$$K_P = \frac{1}{proportional\_range} \quad (1)$$

The error function e(n):

e(n) = set_point - actual_temperature (2)

The regulator output equation:

$$u(n) = K_P\left[e(n) + \frac{e(n)\cdot n}{2\cdot T_i}\right] = K_P \cdot e(n)\left[1 + \frac{n}{2\cdot T_i}\right] \quad (3)$$

Example: The regulator function, equation (3), is evaluated every half minute with the parameters for electric heating (4K/100min) and a constant error function of e(n)=set_point-actual_temp=23-21=2. The calculated output is shown in equation (4), where n is the number of half minute intervals:

$$u(n) = \frac{1}{4}(23-21)\left[1+\frac{n}{2\cdot 100}\right] \quad (4)$$

The graph for the regulator output is shown in Figure 18.

The time factor, n, will be set to 0 when the error function, e(n) becomes 0 or less. The regulator output is capped to maximum 1.0, which is the equivalent of 100% for the control values (control value basic heating or control value basic cooling).

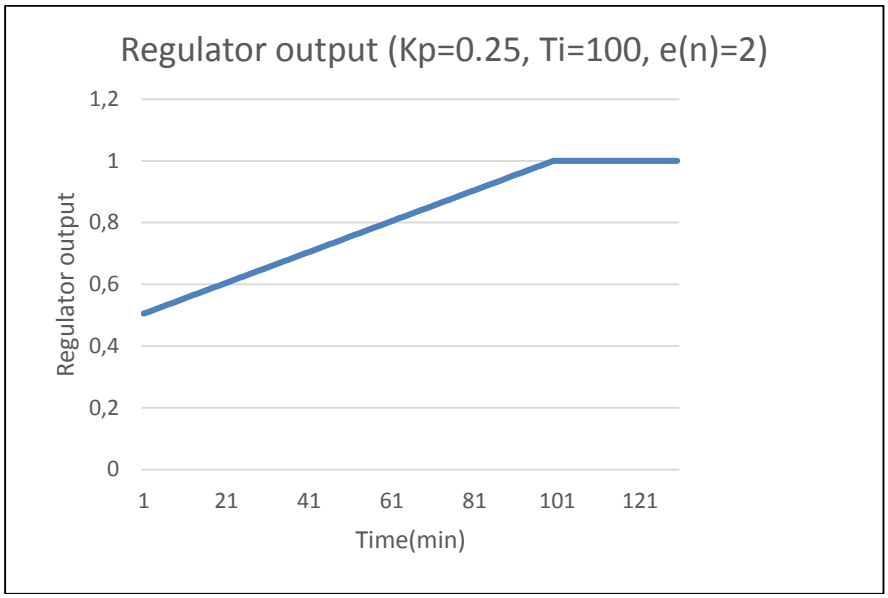


Figure 18 - Regulator output for constant e(n)=2

8.7 Object list

Table 11 - Object list for the Thermostat

Obj.	Object name	Description	Size, flags, DPT
4	Thermostat: Actual local temperature (sensor)	This object shows the measured room temperature (0.1K or 0.5K resolution). This value can also be combined with obj. 5: external temperature. The actual temperature is used as the feedback to the regulator. This object will be sent automatically when the temperature has changed 0.1K, 0.5K or more (defined by parameter). In addition, this object can be set to cyclic sending using assigned parameter. It is only available when either the user panel or temp/humidity sensor is enabled	2 Bytes R-CT-- [9.1] DPT_Value_Temp
5	Thermostat: External temperature	The external temperature can be measured from 0 to 100% compared to obj. 4: Actual local temperature.	2 Bytes -WC--- [9.1] DPT_Value_Temp
6	Thermostat: Base setpoint	The base setpoint is the desired temperature in comfort mode (heating). This value is the origin of all the different regulator modes. The object can be set either to read only or read/write using set parameter. The updated value can either be stored in EEPROM or in volatile memory. This object can be set to cyclic sending.	2 Bytes RWCT-- [9.1] DPT_Value_Temp
7	Thermostat: Actual setpoint	The actual setpoint value that the regulator is using. This can be either the Comfort-, standby-, frost-temperature with the local adjustment (obj. 8 or obj. 9). The object will transmit on change, so the setpoint will be transmitted when the regulator changes mode. This object can be set to cyclic sending using set parameter.	2 Bytes R-CT-- [9.1] DPT_Value_Temp
8	Thermostat: Local adjustment of temp offset	The object holds the local adjustment of temperature offset. This object can be updated either from KNX or from the user panel. Maximum adjustment is +/- 3K from the user panel and +/-10K from the object.	2 Bytes RWCT-- [9.2] DPT_Value_Tempd
9	Thermostat: Local adjustment of temp offset (step)	Step up or down the local temperature offset 1K or 0.5K (using set parameter). Maximum and minimum value can be set using assigned parameter (maximum +/- 3K).	1 Bit -WC--- [1.007] DPT_Step
10	Thermostat: Comfort mode	Sets the regulator in Comfort mode. This mode has 2nd priority.	1 Bit -WC--- [1.2] DPT_Bool
11	Thermostat: Night mode	Sets the regulator in Night mode. This mode has 3rd priority.	1 Bit -WC--- [1.2] DPT_Bool
12	Thermostat: Frost/Heat protecting mode	Sets the regulator in frost/heat protection mode. Frost mode setpoint is fixed at 10°C. Heat protection setpoint is 35°C (fixed limits). This mode has 1st priority.	1 Bit -WC--- [1.2] DPT_Bool
13	Thermostat: Operation mode HVAC	Byte value for setting the HVAC operation mode	1 Byte -WC--- [20.102] DPT_HVACMode

14	Thermostat: Operation mode HVAC feedback	Byte value for indication of the HVAC operation mode	1 Byte R-CT-- [20.102] DPT_HVACMode
15	Thermostat: Control value basic heating Switch	The output of the basic heating regulator. This object is set high if the actual temperature (obj. 4) is lower than obj. 7 “Actual setpoint” - hysteresis. The heating will be turned off when the actual temperature rises above “Actual setpoint”. Cyclic sending every 40 min.	1 Bit R-CT-- [1.1] DPT_Switch
16	Thermostat: Control value basic heating Continuous	Output of the PI regulator with the proportional factor and reset time from the parameter settings. The object can be automatically transmitted based on a %-value change (using set parameter). The integral part can be disabled by setting the reset time parameter to 0, resulting in a P-regulator. Cyclic sending every 40 min.	1 Byte R-CT-- [5.1] DPT_Scaling
17	Thermostat: Control value basic heating Feedback	This object gives the status of the basic heating stage. If the control value for basic heating is 1% or more, this object will be set to “1” and the red heating indication in the user panel and in the movement detector will be lit.	1 Bit R-CT-- [1.1] DPT_Switch
18	Thermostat: Control value add. heating Switch	The additional heating stage will turn “On” if the temperature falls below “actual setpoint – the stage offset temperature from basic to additional stage”. Permanent hysteresis: 0,5K. Cyclic sending every 40 min.	1 Bit R-CT-- [1.1] DPT_Switch
18	Thermostat: Control value add. heating Continuous	Output of the additional stage PI regulator with the proportional factor and reset time from the parameter settings. The object can be automatically transmitted based on a %-value change (using set parameter). The threshold for activating the additional stage output can be specified as a %-value of the basic stage PI output (object 16). Additional stage output will activate if the output value from the basic stage PI output exceeds the threshold value specified by parameter. If the basic stage is configured as switch output, the additional stage will activate when the basic stage output activates (object 15). Cyclic sending every 40 min.	1 Byte R-CT-- [5.1] DPT_Scaling
19	Thermostat: Control value basic cooling Switch	The output of the basic cooling regulator. The target cooling temperature in comfort mode will be ”Base setpoint” + ”Dead zone” + regulator mode temperature parameter. This object is turned “On” if the actual temperature (obj. 4) is higher than the target cooling temperature + hysteresis. The cooling will be turned off when the actual temperature (obj. 4) falls below the target cooling temperature. Cyclic sending every 40 min.	1 Bit R-CT-- [1.1] DPT_Switch

20	Thermostat: Control value basic cooling Continuous	Output of the PI regulator with the proportional factor and reset time from parameter settings. The object can automatically be transmitted based on a %-value change (using set parameter). The integral part can be disabled by setting the reset time parameter to 0, resulting in a P-regulator. Cyclic sending every 40 min.	1 Byte R-CT-- [5.1] DPT_Scaling
21	Thermostat: Control value basic cooling Feedback	This object gives the status of the basic cooling stage. If the control value for basic cooling is 1% or more, this object will be set to “1” and the blue cooling indication in the user panel and movement detector will be lit.	1 Bit R-CT-- [1.1] DPT_Switch
22	Thermostat: Control value add. cooling Switch	The additional cooling stage will turn “On” if the temperature rises above “actual cooling setpoint + the stage offset temperature from basic to additional stage”. Permanent hysteresis: 0,5K. Cyclic sending every 40 min.	1 Bit R-CT-- [1.1] DPT_Switch
22	Thermostat: Control value add. cooling Continuous	Output of the additional stage PI regulator with the proportional factor and reset time from the parameter settings. The object can be automatically transmitted based on a %-value change (using set parameter). The threshold for activating the additional stage output can be specified as a %-value of the basic stage PI output (object 20). Additional stage output will activate if the output value from the basic stage PI output exceeds the threshold value specified by parameter. If the basic stage is configured as switch output, the additional stage will activate when the basic stage output activates (object 19). Cyclic sending every 40 min.	1 Byte R-CT-- [5.1] DPT_Scaling
23	Thermostat: Heating Or Cooling status	Feedback indicating whether the thermostat is in heating mode (true) or cooling mode (false). Can activate heating or cooling mode if the parameter "Automatic changeover heating/cooling mode" is enabled (the W-flag for the object is enabled).	1 Bit R-CT-- [1.1] DPT_Switch

9 Switch actuator

The KNX MultiController has two thermo shunt outputs and can be equipped with 0, 1 or 2 mechanical relays. The thermo shunt and mechanical relay outputs have identical parameter settings and communication objects. The mechanical relay is set to "Switching actuator", and the thermo shunt output is set to "Heating /cooling actuator", by default.

9.1 Parameters

The relay functionality for KNX MultiController includes regular On/Off switch capability, On/Off time delay and staircase function. The basic functionality is offered through five communication objects: "Switch", "Force open", "Force close", "Permanent" and "Status switch".

The relay can be controlled by setting the "Switch" object high or low. The relay can be forced either On or Off by setting the "Force operation" object high. Status feedback from the relay can be read from the communication object "Status switch". See Figure 21 for a block diagram of the relay functions.

Additional functionality for the relay:

1. Staircase functionality
    a. Writable object for the staircase time,
    b. Activation and de-activation of the staircase function.

2. Time delay for turning the relay On or Off.
    a. Extra object for activation and de-activation of the delay function.

3. Extra communication object for logical "AND" or "OR" function.

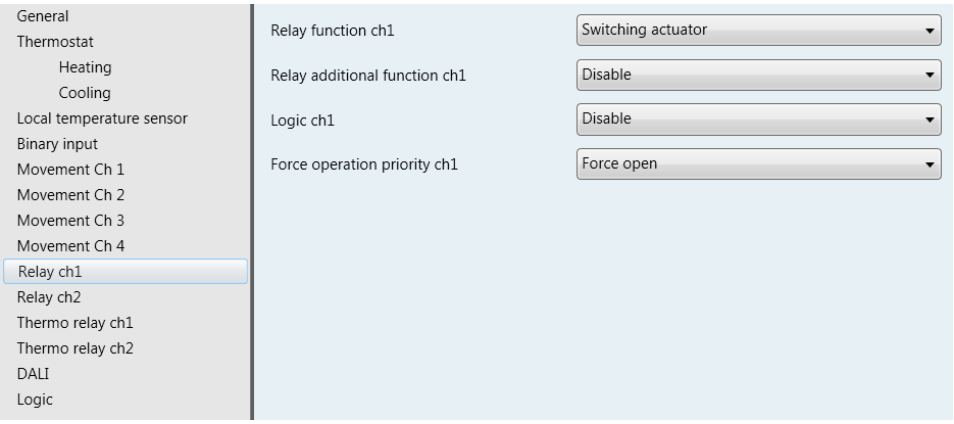


Figure 19 – Default parameters for the relay

9.1.1 Staircase function

The staircase function is defined by a time period parameter measured in minutes. The staircase timer will start when the switch object is set high. The relay is turned off (opened) when the staircase timer has elapsed. The duration value can be changed via an object and this value will be set until the next program download.

The staircase function can be disabled by writing a "1" to the object "Disable staircase function".

It is possible to allow the "switch" object to turn off the relay (open) before the time has elapsed by enabling the parameter "Possibility to switch off the relay from bus".

9.1.2 On/Off Delay function

Separate time delays can be specified for switch On and switch Off. The object "Disable delay function" will appear for the On/Off delay. If the disable delay object is set high, the delay function is disabled and the relay will be a regular switch.

9.1.3 Logic AND/OR

The switching actuator "Logic AND" or "Logic OR" can be enabled using set parameter. The relay output will be determined by the logical object and the regular output of the switch actuator.

The initial value for the "Logic AND" object will be "1". The initial value for the "Logic OR" object will be 0.

9.1.4 Force operation and permanent priority

The permanent object will always have first priority, the 2nd priority can be chosen by the parameter "Force operation priority" for the "Force open" and "Force close" objects.

9.1.5 Heating/cooling actuator

Both mechanical and thermo relays can be configured as a heating/cooling actuator for pulse-width modulation of heating and cooling loads. Se Figure 20 for the parameter window.

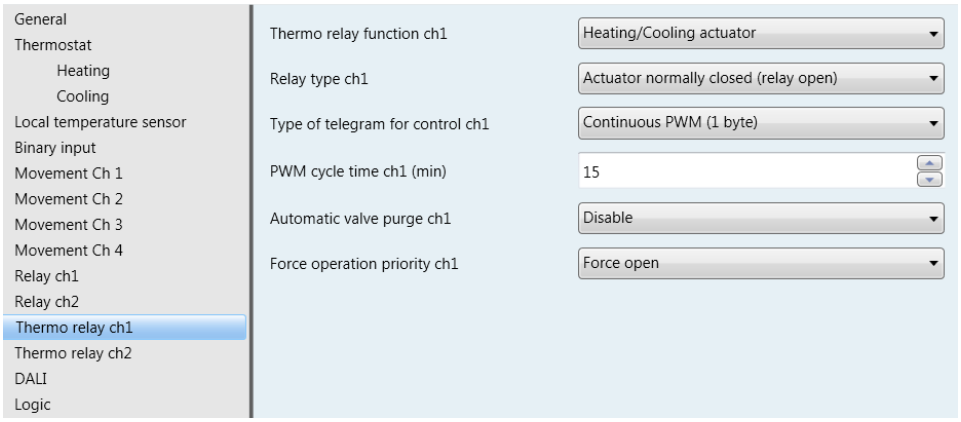


Figure 20 – Default parameters for the thermo relays

"Relay type":
Specifies whether the valve actuator is normally closed (no heat when the relay is open), or normally open (heat when the relay is open).

"Type of telegram for control":
Choose On/Off control (Switch 1-bit object), threshold value (switch 1-byte object) or PWM control (continuous 1-byte object) of the heating or cooling system.

PWM cycle time (min):
Indicates the duration of the PWM control in minutes.

"Automatic valve purge":
Indicates the number of days between valve purge. The valve purge will last for 5 minutes.

"Force priority":
Specifies whether force open or force close has highest priority.

9.2 Initial start-up and power failure considerations

The mechanical relays are turned On for KNX MultiController units that have not been programmed with ETS. This will turn the light and other loads On by default.

When the application program is downloaded to the unit, the start-up procedure will not include turning on the mechanical relays at start-up. A programmed unit will keep the relay unchanged after a power failure of the KNX bus.

The thermo shunt outputs will always be turned off at start-up, regardless of whether the KNX MultiController has been programmed with ETS or not.

9.3 Object list and block diagram

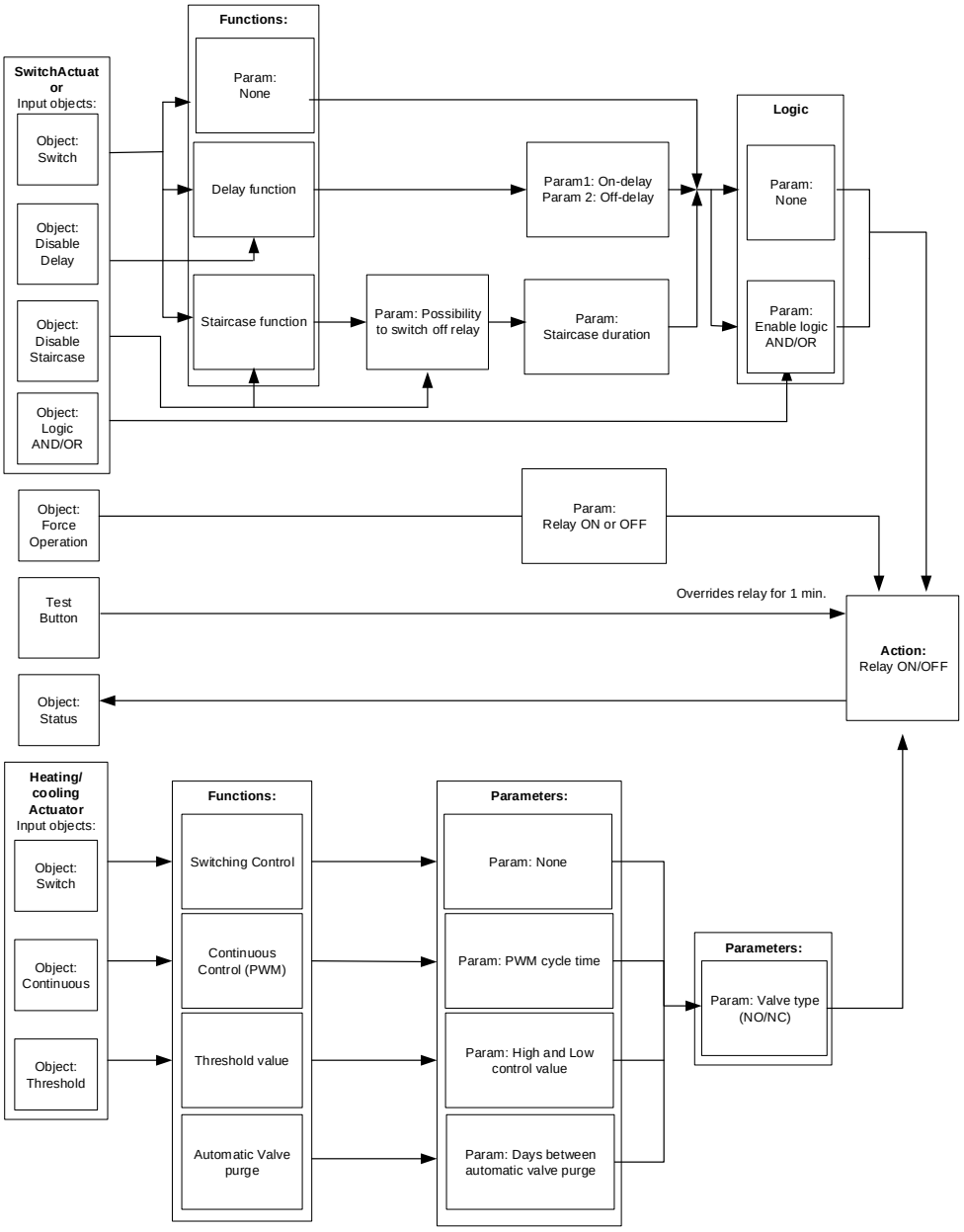


Figure 21 - Block diagram for the switch actuator

Table 12 - Object list for the mechanical relays

Obj.	Object name	Description	Size, flags, DPT
56	Relay 1: Continuous heating/cooling	The object works as continuous (0-100%) control of the heating/cooling system. The object is enabled by choosing "Continuous PWM (1 byte)" for the "Type of telegram for control" parameter.	1 Byte -WC--- [5.1] DPT_Scaling
56	Relay 1: Threshold value heating/cooling (%)	The relay will open and close based on the high and low limits specified by parameters for the heating/cooling system. The object is enabled by choosing "Threshold value (1 byte)" for the "Type of telegram for control" parameter.	1 Byte -WC--- [5.1] DPT_Scaling
56	Relay 1: Switch heating/cooling	The object works as an On/Off control of the heating/cooling system. The object is enabled by choosing "Switch (1 bit)" for the "Type of telegram for control" parameter.	1 Bit -WC--- [1.1] DPT_Switch
56	Relay 1: Switch	This is the switch object to open or close the relay. The object works for switch actuator, delay function and staircase function (1=closed, 0=open).	1 Bit -WC--- [1.1] DPT_Switch
57	Relay 1: Permanent	This object will permanently close the relay. This object has the highest priority and will override all the other relay functions.	1 Bit -WC--- [1.2] DPT_Bool
58	Relay 1: Force open	The relay will be forced Off (open) if this object is set high. The priority of force open and force closed is configured using designated parameter.	1 Bit -WC--- [1.2] DPT_Bool
59	Relay 1: Force close	The relay will be forced On (closed) if this object is set high. The priority of force open and force closed is configured using designated parameter.	1 Bit -WC--- [1.2] DPT_Bool
60	Relay 1: Disable delay	The delay function can be disabled by setting this object high.	1 Bit -WC--- [1.2] DPT_Bool
60	Relay 1: Disable staircase function	The staircase function can be disabled by setting this object high.	1 Bit -WC--- [1.2] DPT_Bool
61	Relay 1: Change staircase duration	Change the timer value for the Staircase function. The value is stored until next program download.	2 Bytes RWC-U- [7.005] DPT_TimePeriod Sec
62	Relay 1: Logic AND	AND gate for the relay output regardless of which function is enabled. Permanent and force operation will override the AND gate. The AND gate is enabled by the parameter ”Logic”. This object has the initial value of “1” after power-on.	1 Bit -WC--- [1.2] DPT_Bool
62	Relay 1: Logic OR	The object works as an OR gate for the relay output regardless of which function is enabled. Permanent and force operation will override the OR gate. The OR gate is enabled by the parameter ”Logic”. This object has the initial value of “0” after power-on.	1 Bit -WC--- [1.2] DPT_Bool
63	Relay 1: Status switch	Holds the status information about the relay output (1=relay closed, 0=relay open)	1 Bit R-CT-- [1.1] DPT_Switch
64	Relay 2: Continuous heating/cooling	The object works as continuous (0-100%) control of the heating/cooling system. The object is enabled by choosing "Continuous PWM (1 byte)" for the "Type of telegram for control" parameter.	1 Byte -WC--- [5.1] DPT_Scaling

64	Relay 2: Switch heating/cooling	The object works as an On/Off control of the heating/cooling system. The object is enabled by choosing "Switch (1 bit)" for the "Type of telegram for control" parameter.	1 Bit -WC--- [1.1] DPT_Switch
64	Relay 2: Threshold value heating/cooling (%)	The relay will open and close based on the high and low limits specified by parameters for the heating/cooling system. The object is enabled by choosing "Threshold value (1 byte)" for the "Type of telegram for control" parameter.	1 Byte -WC--- [5.1] DPT_Scaling
64	Relay 2: Switch	The switch object to open or close the relay. The object works for switch actuator, delay function and staircase function (1=closed, 0=open).	1 Bit -WC--- [1.1] DPT_Switch
65	Relay 2: Permanent	This object will permanently close the relay. This object has the highest priority and will override all the other relay functions.	1 Bit -WC--- [1.2] DPT_Bool
66	Relay 2: Force open	The relay will be forced Off (open) if this object is set high. The priority of force open and force closed is configured using designated parameter.	1 Bit -WC--- [1.2] DPT_Bool
67	Relay 2: Force close	The relay will be forced On (closed) if this object is set high. The priority of force open and force closed is configured using designated parameter.	1 Bit -WC--- [1.2] DPT_Bool
68	Relay 2: Disable delay	The delay function can be disabled by setting this object high.	1 Bit -WC--- [1.1] DPT_Switch
68	Relay 2: Disable staircase function	The staircase function can be disabled by setting this object high.	1 Bit -WC--- [1.2] DPT_Bool
69	Relay 2: Change staircase duration	Change the timer value for the Staircase function. The value is stored until next program download.	2 Bytes RWC-U- [7.005] DPT_TimePeriod Sec
70	Relay 2: Logic AND	AND gate for the relay output regardless of which function is enabled. Permanent and force operation will override the AND gate. The AND gate is enabled by the parameter ”Logic”. This object has the initial value of “1” after power-on.	1 Bit -WC--- [1.2] DPT_Bool
70	Relay 2: Logic OR	The object works as an OR gate for the relay output regardless of which function is enabled. Permanent and force operation will override the OR gate. The OR gate is enabled by the parameter ”Logic”. This object has the initial value of “0” after power-on.	1 Bit -WC--- [1.2] DPT_Bool
71	Relay 2: Status switch	Holds the status information about the relay output (1=relay closed, 0=relay open)	1 Bit R-CT-- [1.1] DPT_Switch

Table 13 - Object list for the thermo shunt relays

72	Thermo relay 1: Continuous heating/cooling	The object works as continuous (0-100%) control of the heating/cooling system. The object is enabled by choosing "Continuous PWM (1 byte)" for the "Type of telegram for control" parameter.	1 Byte -WC--- [5.1] DPT_Scaling
72	Thermo relay 1: Threshold value heating/cooling(%)	The relay will open and close based on the high and low limits specified by parameters for the heating/cooling system. The object is enabled by choosing "Threshold value (1 byte)" for the "Type of telegram for control" parameter.	1 Byte -WC--- [5.1] DPT_Scaling
72	Thermo relay 1: Switch heating/cooling	The object works as an On/Off control of the heating/cooling system. The object is enabled by choosing "Switch (1 bit)" for the "Type of telegram for control" parameter.	1 Bit -WC--- [1.1] DPT_Switch
72	Thermo relay 1: Switch	The switch object to open or close the relay. The object works for switch actuator, delay function and staircase function (1=closed, 0=open).	1 Bit -WC--- [1.1] DPT_Switch
73	Thermo relay 1: Permanent	This object will permanently close the relay. This object has the highest priority and will override all the other relay functions.	1 Bit -WC--- [1.2] DPT_Bool
74	Thermo relay 1: Force open	The relay will be forced Off if this object is set high. The priority of force open and force closed is configured using designated parameter.	1 Bit -WC--- [1.2] DPT_Bool
75	Thermo relay 1: Force close	The relay will be forced On if this object is set high. The priority of force open and force closed is configured using designated parameter.	1 Bit -WC--- [1.2] DPT_Bool
76	Thermo relay 1: Disable delay	The delay function can be disabled by setting this object high.	1 Bit -WC--- [1.2] DPT_Bool
76	Thermo relay 1: Disable staircase function	The staircase function can be disabled by setting this object high.	1 Bit -WC--- [1.2] DPT_Bool
77	Thermo relay 1: Change staircase duration	Change the timer value for the Staircase function. The value is stored until next program download.	2 Bytes RWC-U- [7.005] DPT_TimePeriod Sec
78	Thermo relay 1: Logic AND	AND gate for the relay output regardless of which function is enabled. Permanent and force operation will override the AND gate. The AND gate is enabled by the parameter ”Logic”. This object has the initial value of “1” after power-on.	1 Bit -WC--- [1.2] DPT_Bool
78	Thermo relay 1: Logic OR	The object works as an OR gate for the relay output regardless of which function is enabled. Permanent and force operation will override the OR gate. The OR gate is enabled by the parameter ”Logic”. This object has the initial value of “0” after power-on.	1 Bit -WC--- [1.2] DPT_Bool
79	Thermo relay 1: Status switch	Holds the status information about the relay output (1=relay closed, 0=relay open)	1 Bit R-CT-- [1.1] DPT_Switch
80	Thermo relay 2: Switch	The switch object to open or close the relay. The object works for switch actuator, delay function and staircase function (1=closed, 0=open).	1 Bit -WC--- [1.1] DPT_Switch
80	Thermo relay 2: Switch heating/cooling	The object works as an On/Off control of the heating/cooling system. The object is enabled by choosing "Switch (1 bit)" for the "Type of telegram for control" parameter.	1 Bit -WC--- [1.1] DPT_Switch

80	Thermo relay 2: Continuous heating/cooling	The object works as continuous (0-100%) control of the heating/cooling system. The object is enabled by choosing "Continuous PWM (1 byte)" for the "Type of telegram for control" parameter.	1 Byte -WC--- [5.1] DPT_Scaling
80	Thermo relay 2: Threshold value heating/cooling(%)	The relay will open and close based on the high and low limits specified by parameters for the heating/cooling system. The object is enabled by choosing "Threshold value (1 byte)" for the "Type of telegram for control" parameter.	1 Byte -WC--- [5.1] DPT_Scaling
81	Thermo relay 2: Permanent	This object will permanently close the relay. This object has the highest priority and will override all the other relay functions.	1 Bit -WC--- [1.2] DPT_Bool
82	Thermo relay 2: Force open	The relay will be forced Off if this object is set high. The priority of force open and force closed is configured using designated parameter.	1 Bit -WC--- [1.2] DPT_Bool
83	Thermo relay 2: Force close	The relay will be forced On if this object is set high. The priority of force open and force closed is configured using designated parameter.	1 Bit -WC--- [1.2] DPT_Bool
84	Thermo relay 2: Disable staircase function	The staircase function can be disabled by setting this object high.	1 Bit -WC--- [1.2] DPT_Bool
84	Thermo relay 2: Disable delay	The delay function can be disabled by setting this object high.	1 Bit -WC--- [1.2] DPT_Bool
85	Thermo relay 2: Change staircase duration	Change the timer value for the Staircase function. The value is stored until next program download.	2 Bytes RWC-U- [7.005] DPT_TimePeriod Sec
86	Thermo relay 2: Logic AND	AND gate for the relay output regardless of which function is enabled. Permanent and force operation will override the AND gate. The AND gate is enabled by the parameter ”Logic”. This object has the initial value of “1” after power-on.	1 Bit -WC--- [1.2] DPT_Bool
86	Thermo relay 2: Logic OR	The object works as an OR gate for the relay output regardless of which function is enabled. Permanent and force operation will override the OR gate. The OR gate is enabled by the parameter ”Logic”. This object has the initial value of “0” after power-on.	1 Bit -WC--- [1.2] DPT_Bool
87	Thermo relay 2: Status switch	Holds the status information about the relay output (1=relay closed, 0=relay open)	1 Bit R-CT-- [1.1] DPT_Switch

10 Binary inputs

KNX MultiController has two digital inputs (1 and 2) that can be used as a simple switch, dimming switch or shutter control switch. The simple switch can be configured as On, Off or Toggle. Detection of short and long switch operation will be determined for dimming- and shutter switch.

Switch

Switch functionality, where the object is high or low depending on the detection of rising or falling edge for the input.

Parameter choices for the Switch-function:
Rising edge – On
Rising edge – Off
Rising edge – Toggle
Rising edge – On, Falling edge – Off
Rising edge – Off, Falling edge – On

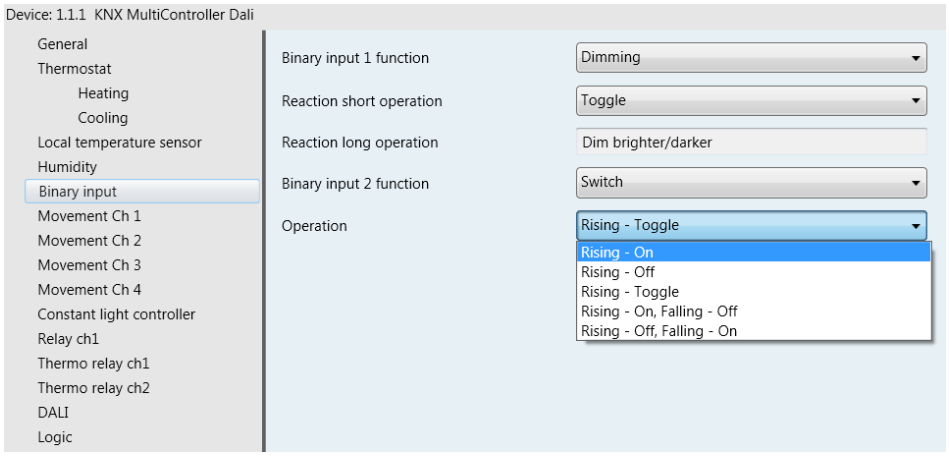


Figure 22 - Configuration options for binary switch input

Dimming

Light dimming functionality, with one communication object for "Short operation – Switch" and one for "Long operation - dimming".

Parameter choices for the dimming function:
Reaction short operation: "Off", "On" or "Toggle"
Reaction long operation: "Dim darker", "Dim brighter" or "Dim brighter/darker"

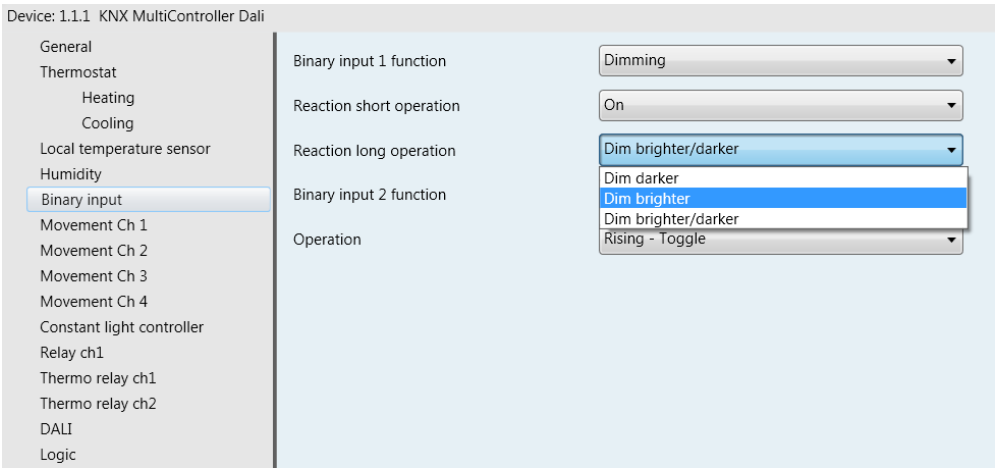


Figure 23 - Dimming input configuration

NOTE: if the reaction for short operation is "Toggle", the action for long operation is locked to "Dim brighter/darker".

Shutter

Shutter control with one object for "Short operation - stop/step" and one object for "Long operation - up/down".

Parameter choices for the shutter control:
Reaction short operation: "Stop/Up", "Stop/Down" or "Stop/Toggle Up/Down"
Reaction long operation: "Up", "Down" or "Toggle Up/Down"

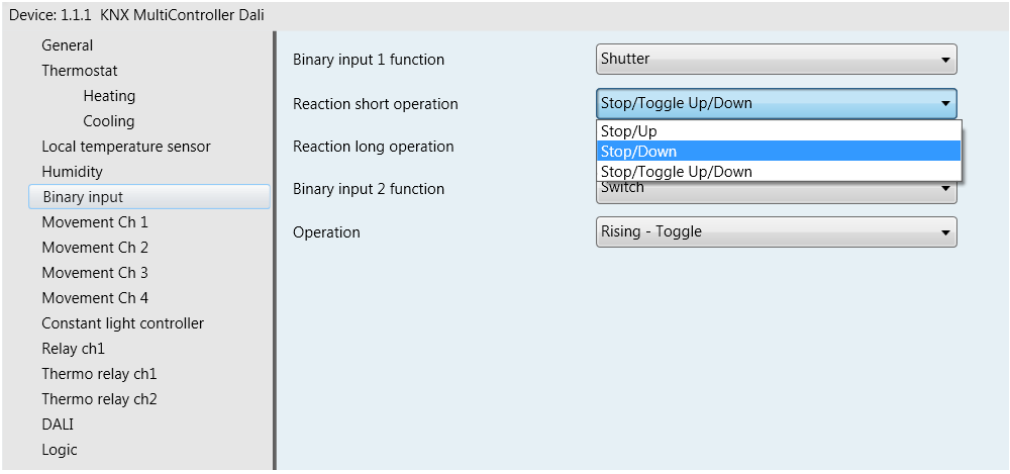


Figure 24 – Shutter input configuration

NOTE: if the reaction for short operation is "Stop/Toggle Up/Down", the action for long operation is locked to "Toggle Up/Down".

Value (scene)

A rising edge on the binary inputs will result in the transmission of a value (0..255) on the KNX bus. The value can be linked with the scene controller to set the DALI lamps, mechanical relays and ventilation according to predefined values.

Example:
The binary input 1 can be connected to an impulse switch. When the impulse switch is pressed, a scene value is transmitted to the KNX bus. DALI group 0-3 and the 3 general

purpose scene objects will not only set the pre-defined light levels, but can also set the state of the mechanical relays, set comfort mode and open ventilation to a specified level.

The binary inputs with Value functionality allow for several control strategies for turning on and off:

1. **Control type: manual ON and automatic OFF**
   The binary input will turn on the light and ventilation and the movement detector can send a scene value that turns off the light and ventilation when the room is no longer in use

2. **Control type: manual ON and manual OFF**
   Binary input 1 will turn on the light scene and binary input 2 can set a scene that turns off the light and ventilation

3. **Control type: automatic ON and automatic OFF, with manual override**
   The movement detector control light and ventilation both ON and OFF, the binary input is only used for a predefined light scene.

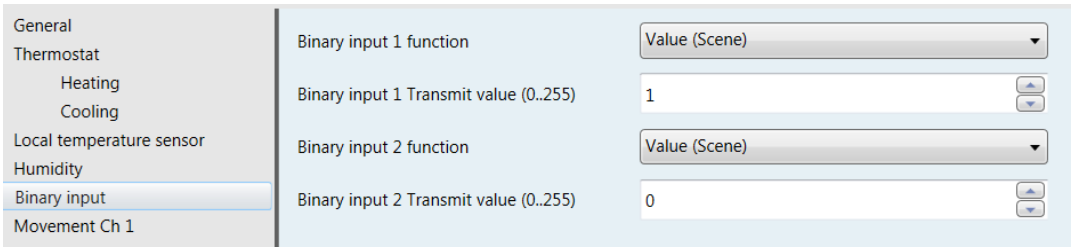


Figure 25 – Shutter input configuration

10.1 Object list and block diagram

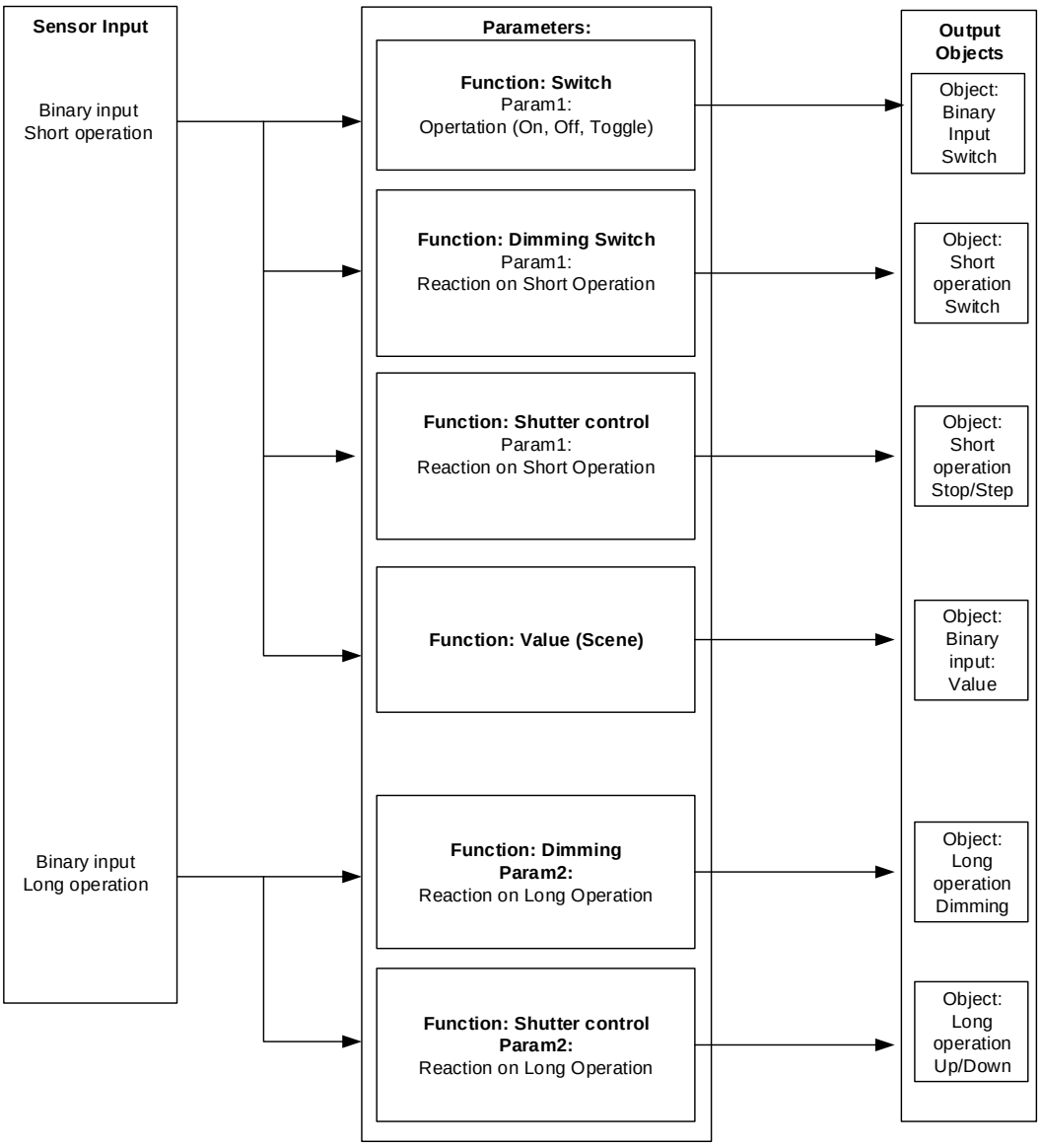


Figure 26 - Block diagram for binary inputs

Table 14 - Object list for Binary Input 1 and Binary Input 2

Obj.	Object name	Description	Size, flags, DPT
24	Binary input 1: Short operation - Stop/Step	This object appears if the input is set to “Shutter”. The object is transmitted if a pulse with duration between 50 ms and 500 ms is detected on external input 1. The action can be “Stop/Down”, “Stop/Up” or “Stop/Toggle Up/Down” depending on the parameter.	1 Bit --CT-- [1.007] DPT_Step
24	Binary input 1: Short operation - Switch	This object appears if the input is set to “Dimming”. The object is transmitted if a pulse with duration between 50 ms and 500 ms is detected on external input 1. The action depends on the parameter and can be: “On”, “Off” or “Toggle"	1 Bit --CT-- [1.1] DPT_Switch
24	Binary input 1: Value	This object appears if the input is set to “Value (scene)”. The object is transmitted if a pulse from low to high with duration between 50 ms and 500 ms is detected on the binary input. The value (0..255) defined in parameter will be transmitted to the bus when the input is triggered.	1 Byte --CT-- [1.1] DPT_Switch
25	Binary input 1: Switch	This object appears if the input is set to “Switching”. The object is transmitted if the pulse on the external input 1 is at least 50 ms long, with no maximum duration. Action on rising edge and falling edge: “Rising – On”, “Rising – Off”, “Rising – Toggle”, “Rising – On, Falling – Off” or “Rising – Off, Falling – On”	1 Bit --CT-- [1.1] DPT_Switch
25	Binary input 1: Long operation - Up/Down	This object appears if the input is set to “Shutter”. If the external input is high for more than 500 ms, the telegram will move the shutter up, down or toggle (depending on the parameter). The action can be: “Up”, “Down” or “Toggle Up/Down”	1 Bit --CT-- [1.8] DPT_UpDown
25	Binary input 1: Long operation - Dimming	This object appears if the input is set to “Dimming”. If the external input is high for more than 500 ms, the telegram will dim up, down or up/down. The action can be: “Dim darker”, “Dim brighter” or “Dim brighter/darker”	4 Bit --CT-- [3.7] DPT_Control_Dimming
26	Binary input 2: Short operation - Switch	This object appears if the input is set to “Dimming”. The object is transmitted if a pulse with duration between 50 ms and 500 ms is detected on external input 2. The action depends on the parameter and can be: “On”, “Off” or “Toggle"	1 Bit --CT-- [1.1] DPT_Switch

26	Binary input 2: Short operation - Stop/Step	This object appears if the input is set to “Shutter”. The object is transmitted if a pulse with duration between 50 ms and 500 ms is detected on external input 2. Action on rising edge. The action can be “Stop/Down”, “Stop/Up” or “Stop/Toggle Up/Down” depending on the parameter.	1 Bit --CT-- [1.007] DPT_Step
26	Binary input 2: Value	This object appears if the input is set to “Value (scene)”. The object is transmitted if a pulse from low to high with duration between 50 ms and 500 ms is detected on the binary input. The value (0..255) defined in parameter will be transmitted to the bus when the input is triggered.	1 Byte --CT-- [1.1] DPT_Switch
27	Binary input 2: Switch	This object appears if the input is set to “Switching”. The object is transmitted if the pulse on the external input 2 is at least 50 ms long, with no maximum duration. Action on rising edge and falling edge: “Rising – On”, “Rising – Off”, “Rising – Toggle”, “Rising – On, Falling – Off” or “Rising – Off, Falling – On”	1 Bit --CT-- [1.1] DPT_Switch
27	Binary input 2: Long operation - Up/Down	This object appears if the input is set to “Shutter”. If the external input is high for more than 500 ms, the telegram will move the shutter up, down or toggle (depending on the parameter). The action can be: “Up”, “Down” or “Toggle Up/Down”	1 Bit --CT-- [1.8] DPT_UpDown
27	Binary input 2: Long operation - Dimming	This object appears if the input is set to “Dimming”. If the external input is high for more than 500 ms, the telegram will dim up, down or up/down. The action can be: “Dim darker”, “Dim brighter” or “Dim brighter/darker”	4 Bit --CT-- [3.7] DPT_Control_Dimming

11 Humidity sensor

The KNX MultiController includes a limit switch for relative humidity and a dew point switch. The humidity functions are available only with the movement sensors 5201x that include a combined temperature and humidity sensor. The humidity functionality can be enabled by activating both the parameter "Activation of local temperature sensor" and "Activation of Temp/Humidity sensor" in the "General" tab.

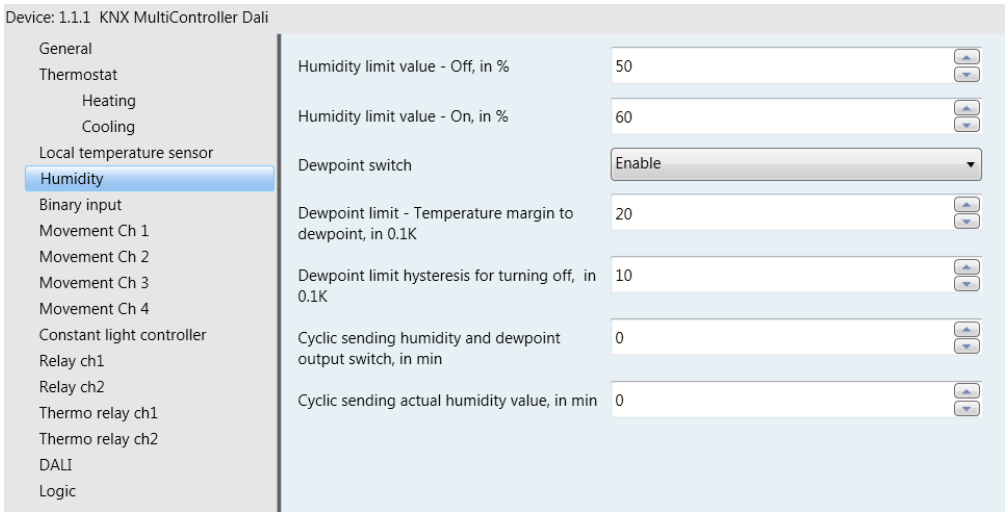


Figure 27 - Parameters for the humidity sensor

11.1 Relative humidity limit switch

The limit switch communication object is set high if the relative humidity value is higher than the parameter "Humidity limit value – On, in %" and will be set low if the relative humidity value is less than parameter "Humidity limit value – Off, in %"

The relative humidity value will be se sent automatically if altered and can be set to cyclic sending using designated parameters.

The output switch for humidity switch and dew point switch are sent automatically if altered and can also be set to cyclic sending.

11.2 Dew point switch

The dew point switch communication object will be set high if the calculated dew point temperature and the external temperature communication object are closer than the parameter "Dew point limit – Temperature margin to dew point, in 0.1K".

The dew point switch communication object will be set low when the difference between the external temperature and the calculated dew point temperature is larger than the temperature margin to dew point + dew point limit hysteresis.

11.3 Object list

Table 15 - Object list for the humidity and dew point switch

Obj.	Object name	Description	Size, flags, DPT
52	Humidity: Relative value	The relative humidity value from the humidity sensor. Only available when the Temp/Humidity sensor (5201x) is enabled in the General tab.	2 Bytes R-CT-- [9.007] HDPT_Value_Humidity
53	Humidity: Limit switch	Limit switch for high and low relative humidity values. The object is 1 if the humidity value is higher or equal to the On limit value and 0 if the value is below the Off value. Only available for Temp/Humidity sensor (5201x).	1 Bit R-CT-- [1.2] DPT_Bool
54	Humidity: Dewpoint switch	This object is 1 if the calculated dew point temperature is closer to the "External temperature for dew point" than the parameter "Temperature margin to dew point". Only available for Temp/Humidity sensor (5201x).	1 Bit R-CT-- [1.2] DPT_Bool
55	Humidity: External temperature for dewpoint	External temperature used for comparing the calculated dew point temperature. Only available for Temp/Humidity sensor (5201x)	2 Bytes -WC--- [9.1] DPT_Value_Temp

12 Analog I/O

The IOana analog I/O extension shown in Figure 28 is a general purpose analog input and output module. The KNX MultiController with the IOana extension is capable of controlling VAV ventilation dampers and valve motors for heating- and cooling control. Up to two 0-10V input and output modules can be connected to the digital extension port of the MultiController by cable. A system configuration with movement, user panel and IOana is shown in Figure 33

Figure 28 - MultiController with the IOana 0-10V single input and output extension

12.1 VAV damper control

The IOana extension can control a VAV damper motor by a 0-10V control signal. Output voltages for 0% and 100% ventilation can be changed by parameters (see Figure 29). Also, the 0% voltage and 100% voltage for the analog input signal can be defined as

needed. This functionality will for example handle ventilation dampers where 2V output equals 0% and 9V output equals 100%.

Output object as voltage or percent

The parameter "Output object configuration" (see Figure 29) can either configure the "Output control value" object as a percentage or as the output voltage*10. If the parameter is set to percent, the result of the comparator function will be transmitted for the "Output control value" object.

If the parameter is set to "Voltage (volt*10)", the actual output voltage will be transmitted for the "Output control value" object. If the "Output voltage for 100% level in 0.1V" is set to 50 (5 volts) and the highest comparator input is 100%, then the "Output control value" object will be 50 (127 in raw value). The information of the actual control voltage can be used by the building management system for indication of air volumes supplied by the different ventilation dampers.

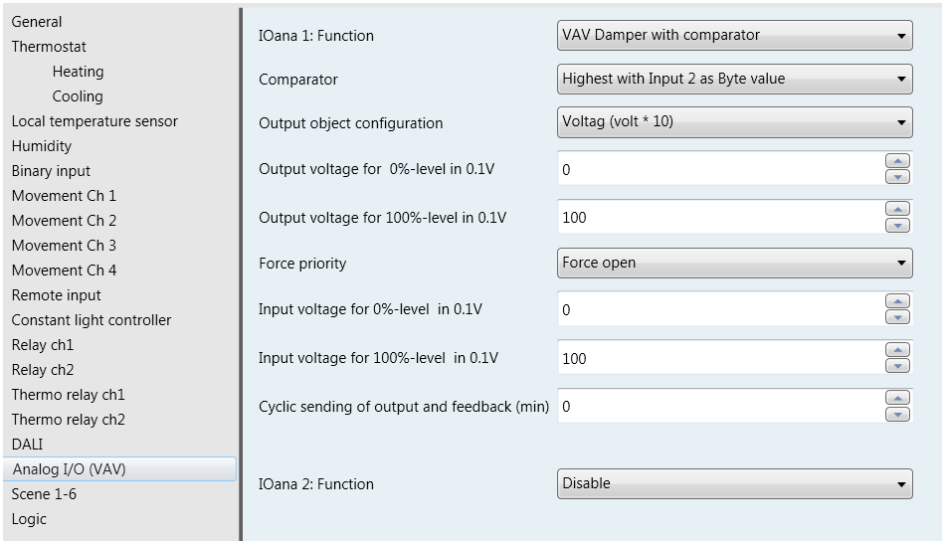


Figure 29 - Parameters for VAV damper control

12.2 Objects for VAV damper control

Obj.	Object name	Description	Size, flags, DPT
138	IOana 1: Input 1 - Value	Input value 1 (0..100%) for the analog output.	1 Byte -WC--- [5.1] DPT_Scaling
139	IOana 1: Input 2 - Switch	Input value 2 (switch) when the comparator is active. The value from parameter is used as comparator value 2 if this switch is set high. Value 0 is used for comparator value 2 if this object is not set.	1 Bit -WC--- [1.1] DPT_Switch
139	IOana 1: Input 2 - Value	Input value 2 (0..100%) when the comparator is active.	1 Byte -WC--- [5.1] DPT_Scaling
140	IOana 1: Output control value - Highest (% of 10V)	The highest output value from the comparator calculated in % of 10V for indication of actual valve motor control voltage.	1 Byte R-CT-- [5.1] DPT_Scaling
140	IOana 1: Output control value - Highest (%)	The highest output value in % from the comparator.	1 Byte R-CT-- [5.1] DPT_Scaling

140	IOana 1: Output control value - Average (% of 10V)	The average output value from the comparator calculated in % of 10V for indication of actual valve motor control voltage.	1 Byte R-CT-- [5.1] DPT_Scaling
140	IOana 1: Output control value - Average (%)	The average output value in % from the comparator.	1 Byte R-CT-- [5.1] DPT_Scaling
140	IOana 1: Output control value (% of 10V)	The output value with a disabled comparator calculated in % of 10V for indication of actual valve motor control voltage.	1 Byte R-CT-- [5.1] DPT_Scaling
140	IOana 1: Output control value (%)	The output value with a disabled comparator in %.	1 Byte R-CT-- [5.1] DPT_Scaling
141	IOana 1: Feedback (% of input voltage range)	The measured value of the analog input voltage in percent of the input voltage range.	1 Byte R-CT-- [5.1] DPT_Scaling
142	IOana 1: Force open	Force function to open the VAV damper. Sets the output voltage to 10V.	1 Bit -WC--- [1.2] DPT_Bool
143	IOana 1: Force close	Force function to close the VAV damper. Sets the output voltage to 0V.	1 Bit -WC--- [1.2] DPT_Bool
144	IOana 1: Alarm	Alarm flag is set high if the IOana extension is not working.	1 Bit R-CT-- [1.2] DPT_Bool
145	IOana 2: Input 1 - Value	Input value 1 (0..100%) for the analog output.	1 Byte -WC--- [5.1] DPT_Scaling
146	IOana 2: Input 2 - Switch	Input value 2 (switch) when the comparator is active. The value from parameter is used as comparator value 2 if this switch is set high. Value 0 is used for comparator value 2 if this object is not set.	1 Bit -WC--- [1.1] DPT_Switch
146	IOana 2: Input 2 - Value	Input value 2 (0..100%) when the comparator is active.	1 Byte -WC--- [5.1] DPT_Scaling
147	IOana 2: Output control value - Highest (% of 10V)	The highest output value from the comparator calculated in % of 10V for indication of actual valve motor control voltage.	1 Byte R-CT-- [5.1] DPT_Scaling
147	IOana 2: Output control value - Highest (%)	The highest output value in % from the comparator.	1 Byte R-CT-- [5.1] DPT_Scaling
147	IOana 2: Output control value - Average (% of 10V)	The average output value from the comparator calculated in % of 10V for indication of actual valve motor control voltage.	1 Byte R-CT-- [5.1] DPT_Scaling
147	IOana 2: Output control value - Average (%)	The average output value in % from the comparator.	1 Byte R-CT-- [5.1] DPT_Scaling
147	IOana 2: Output control value (% of 10V)	The highest output value from the comparator calculated in % of 10V for indication of actual valve motor control voltage.	1 Byte R-CT-- [5.1] DPT_Scaling
147	IOana 2: Output control value (%)	The output value with a disabled comparator calculated in % of 10V for indication of actual valve motor control voltage.	1 Byte R-CT-- [5.1] DPT_Scaling
148	IOana 2: Feedback (% of input voltage range)	The measured value of the analog input voltage in percent of the input voltage range.	1 Byte R-CT-- [5.1] DPT_Scaling

149	IOana 2: Force open	Force function to open the VAV damper. Sets the output voltage to 10V.	1 Bit -WC--- [1.2] DPT_Bool
150	IOana 2: Force close	Force function to close the VAV damper. Sets the output voltage to 0V.	1 Bit -WC--- [1.2] DPT_Bool
151	IOana 2: Alarm	Alarm flag is set high if the IOana extension is not working.	1 Bit R-CT-- [1.2] DPT_Bool

12.3 Combined heating and cooling control with 6-way valves

The analog I/O extension can be configured to control a 6-Way valve for combined control of heating and cooling. One motorized 6-way valve can control a four pipe system using a single coil as shown in Figure 30.

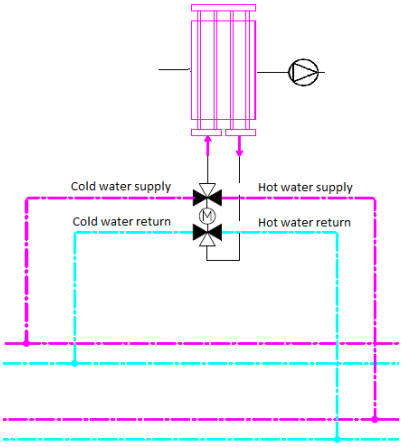


Figure 30 - 6-Way valve for combined heating and cooling control

The typical characteristic used by Belimo 6-way valve motor is shown in Figure 31. The coil will start to cool if the analog output is less than 4.7 volts, and heating will start if the output is more than 7.3 volts. The voltages for 0% and 100% heating and cooling can be set in parameters for the KNX MultiController. The default parameters shown in Figure 32 are set according to the characteristic shown in Figure 31. However, if the installation require higher circulation for low heating and cooling control values, the voltages for 0% level can be altered to for example 45 (4.5 volt) and 75 (7.5 volt).

The force heating and force cooling objects will either force the output to 10V for heating or 0V for cooling. The force objects are useful when commissioning and testing the heating and cooling system.

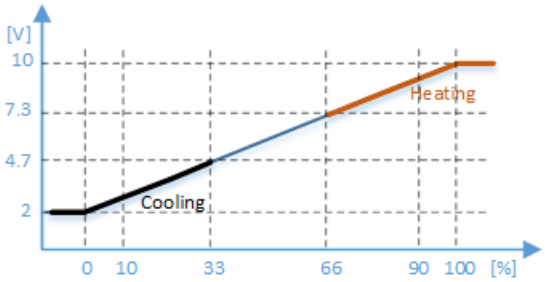


Figure 31 - Output voltage for cooling and heating

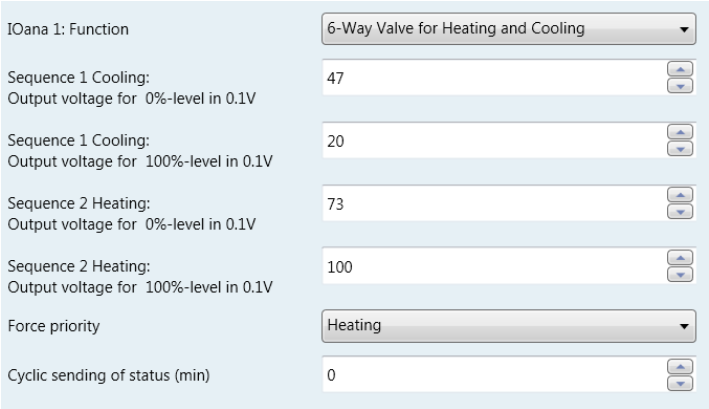


Figure 32 - Standard parameters for heating and cooling control

12.4 Objects for 6-way valve

Obj.	Object name	Description	Size, flags, DPT
138	IOana 1: Sequence 1 - Cooling - Value	Input value (0..100%) for 6-way valve cooling. The valve will open for cold water if this object is set higher than 0%.	1 Byte -WC--- [5.1] DPT_Scaling
139	IOana 1: Sequence 2 - Heating - Value	Input value (0..100%) for 6-way valve heating. The valve will open for hot water if this object is set higher than 0%.	1 Byte -WC--- [5.1] DPT_Scaling
140	IOana 1: Sequence 1 - Cooling value status	Feedback value (0..100%) for cooling.	1 Byte R-CT-- [5.1] DPT_Scaling
141	IOana 1: Sequence 2 - Heating value status	Feedback value (0..100%) for heating.	1 Byte R-CT-- [5.1] DPT_Scaling
142	IOana 1: Sequence 1 - Force cooling	Force function to activate cooling mode for a 6-way valve. The output voltage is set to 0V	1 Bit -WC--- [1.2] DPT_Bool
143	IOana 1: Sequence 2 - Force heating	Force function to activate heating mode for a 6-way valve. The output voltage is set to 10V	1 Bit -WC--- [1.2] DPT_Bool
144	IOana 1: Alarm	Alarm flag is set high if the IOana extension is not working.	1 Bit R-CT-- [1.2] DPT_Bool
145	IOana 2: Sequence 1 - Cooling - Value	Input value (0..100%) for 6-way valve cooling. The valve will open for cold water if this object is set higher than 0%.	1 Byte -WC--- [5.1] DPT_Scaling

146	IOana 2: Sequence 2 - Heating - Value	Input value (0..100%) for 6-way valve heating. The valve will open for hot water if this object is set higher than 0%.	1 Byte -WC--- [5.1] DPT_Scaling
147	IOana 2: Sequence 1 - Cooling value status	Feedback value (0..100%) for cooling.	1 Byte R-CT-- [5.1] DPT_Scaling
148	IOana 2: Sequence 2 - Heating value status	Feedback value (0..100%) for heating.	1 Byte R-CT-- [5.1] DPT_Scaling
149	IOana 2: Sequence 1 - Force cooling	Force function to activate cooling mode for a 6-way valve. The output voltage is set to 0V	1 Bit -WC--- [1.2] DPT_Bool
150	IOana 2: Sequence 2 - Force heating	Force function to activate heating mode for a 6-way valve. The output voltage is set to 10V	1 Bit -WC--- [1.2] DPT_Bool
151	IOana 2: Alarm	Alarm flag is set high if the IOana extension is not working.	1 Bit R-CT-- [1.2] DPT_Bool

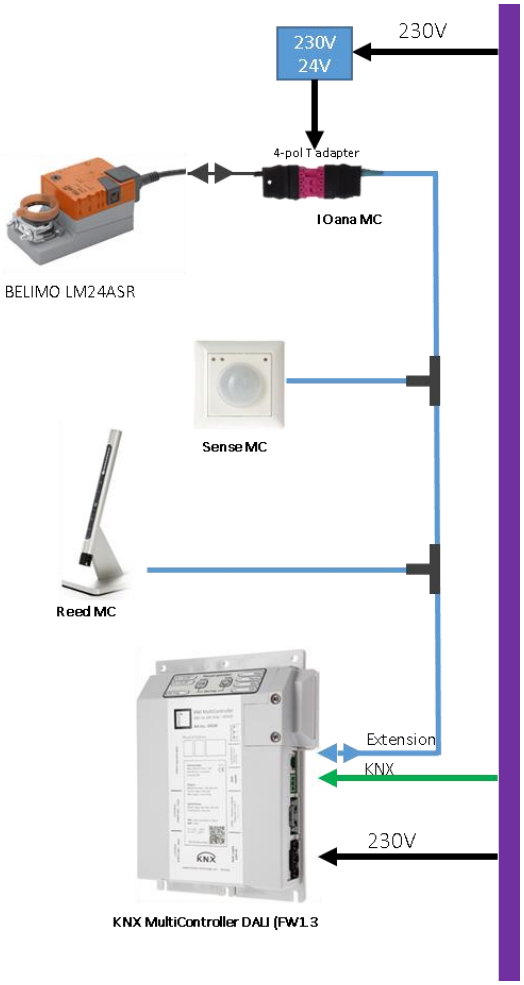


Figure 33 - Typical system configuration (24V VAV motor)

13 Scene controller

The scene controller can control the DALI groups 0-3 internally (not linked by objects) as well as three general purpose objects. The three general purpose objects can individually be configured as either 1-bit switch or 1-byte value data type.

The scene controller can work with up to 6 different value sets. The value sets should primarily be set by the visualisation of the building management system. The save/store sequence needed to update the value sets will write the new values to the permanent memory of the controller. The 4 DALI dim values and the 3 general purpose values can be set by following this procedure:

1. Start a save sequence by writing "127+ scene number" to the control byte (object 152)
2. Write all the "SCENE: Store .." values that should be set by scene number (the "SCENE: Store .." values that are not written to will be omitted for the scene)
3. Store the scene by writing "127+ scene number" to the control byte

Note: The scene values for the specific scene will be blanked out if point 1 is done twice without sending any "SCENE: Store .." values.

Enabling the parameter "Permanent scene 1 and 2" will make scene 1 and 2 permanent. It will not be possible to alter scene 1 and 2 value sets by using the procedure above. The value sets used by scene 1 and 2 has to be specified by parameters in the ETS program. Parameter window for permanent scene 1 is shown in Figure 35. Please note that omitting DALI groups from the value set for the permanent scenes is done by writing the 101 as the DALI group value.

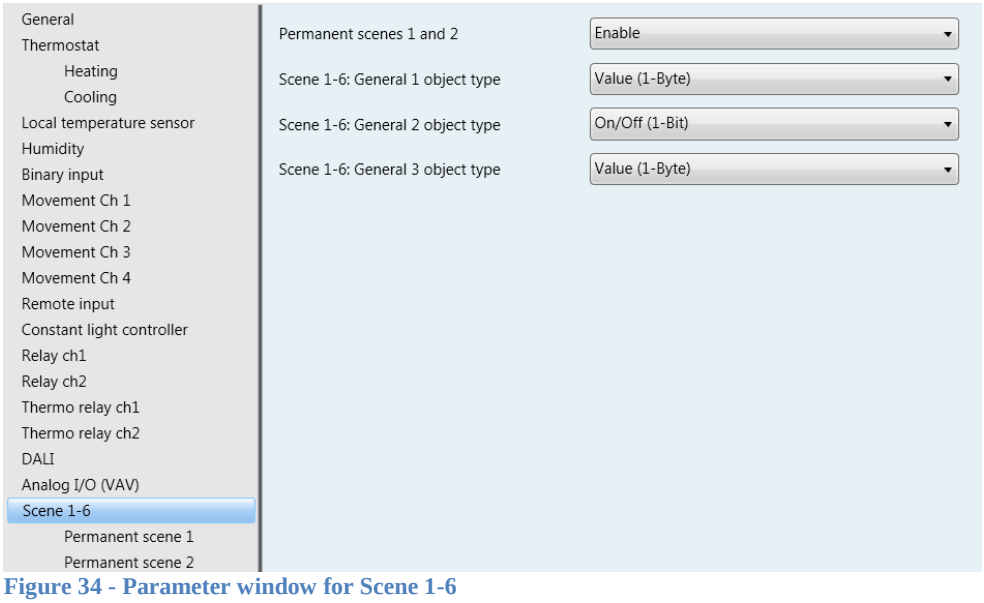


Figure 34 - Parameter window for Scene 1-6

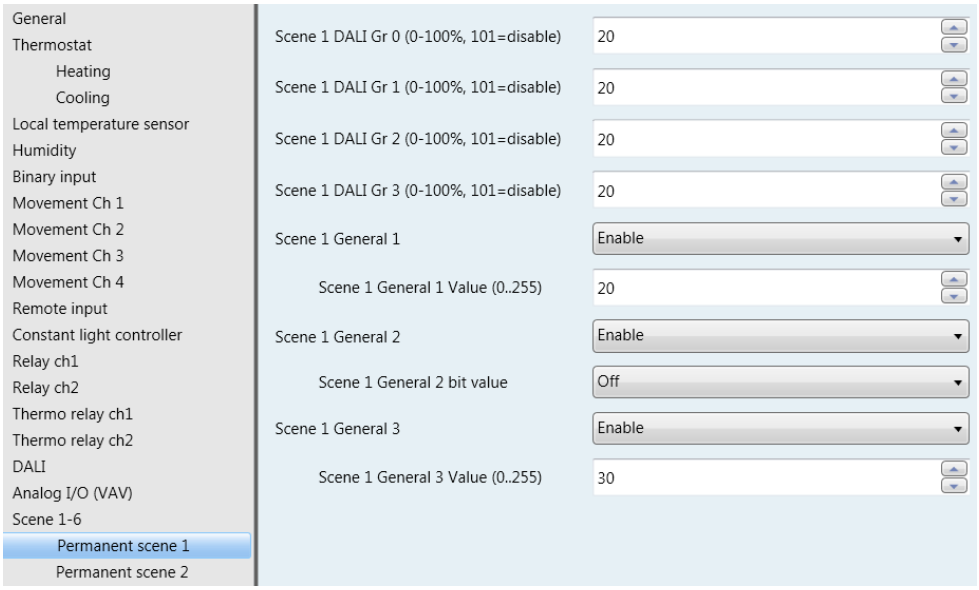


Figure 35 - Parameter window for permanent scene 1

13.1 Object list

Obj.	Object name	Description	Size, flags, DPT
152	SCENE: Control 1-6 (Call:0-5 Save/Store:128-133)	Scene 1 to 6 can be activated by writing values from 0 to 5 to this object. Only the values enabled either in parameters for the two permanent scenes or by the update procedure below will be transmitted when the scene is called. The scenes can be updated by first writing a save command 128-133 for scene 1 to 6. All the individual "SCENE: store ..." objects that are needed for the scene must be updated within a 1 minute timeout. Repeating the store command (128-133) will cause the controller to store the new values permanently. Note: scene 1 and 2 can be configured by parameters to be permanent. Scene 1 and 2 can't be updated by the procedure above if permanent scene 1 and 2 is enabled.	1 Byte -WC---
153	SCENE: Store DALI Group 0	This object is used for updating a scene value for DALI group 0 dimming value. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Byte -WC--- [5.1] DPT_Scaling
154	SCENE: Store DALI Group 1	This object is used for updating a scene value for DALI group 1 dimming value. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Byte -WC--- [5.1] DPT_Scaling
155	SCENE: Store DALI Group 2	This object is used for updating a scene value for DALI group 2 dimming value. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Byte -WC--- [5.1] DPT_Scaling
156	SCENE: Store DALI Group 3	This object is used for updating a scene value for DALI group 3 dimming value. The object will only receive a value for a duration of 1 minute after a	1 Byte -WC--- [5.1] DPT_Scaling

		save command has been written to the "SCENE: Control" object.	
157	SCENE: Store General 1 - Value	This object is used for updating the general 1 value. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Byte -WC--- [5.10] DPT_Value_1_Ucount
157	SCENE: Store General 1 - Switch	This object is used for updating the general 1 switch. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Bit -WC--- [1.1] DPT_Switch
158	SCENE: Store General 2 - Value	This object is used for updating the general 2 value. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Byte -WC--- [5.10] DPT_Value_1_Ucount
158	SCENE: Store General 2 - Switch	This object is used for updating the general 2 switch. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Bit -WC--- [1.1] DPT_Switch
159	SCENE: Store General 3 - Value	This object is used for updating the general 3 value. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Byte -WC--- [5.10] DPT_Value_1_Ucount
159	SCENE: Store General 3 - Switch	This object is used for updating the general 3 switch. The object will only receive a value for a duration of 1 minute after a save command has been written to the "SCENE: Control" object.	1 Bit -WC--- [1.1] DPT_Switch
160	SCENE: Output General 1 - Value	This object will transmit the scene value after the scene is called by the "SCENE: Control" object. The object will not be transmitted if it is disabled in parameters or if no value has been saved for the scene.	1 Byte --CT-- [5.10] DPT_Value_1_Ucount
160	SCENE: Output General 1 - Switch	This object will transmit the scene switch after the scene is called by the "SCENE: Control" object. The object will not be transmitted if it is disabled in parameters or if no value has been saved for the scene.	1 Bit --CT-- [1.1] DPT_Switch
161	SCENE: Output General 2 - Value	This object will transmit the scene value after the scene is called by the "SCENE: Control" object. The object will not be transmitted if it is disabled in parameters or if no value has been saved for the scene.	1 Byte --CT-- [5.10] DPT_Value_1_Ucount
161	SCENE: Output General 2 - Switch	This object will transmit the scene switch after the scene is called by the "SCENE: Control" object. The object will not be transmitted if it is disabled in parameters or if no value has been saved for the scene.	1 Bit --CT-- [1.1] DPT_Switch
162	SCENE: Output General 3 - Value	This object will transmit the scene value after the scene is called by the "SCENE: Control" object. The object will not be transmitted if it is disabled in parameters or if no value has been saved for the scene.	1 Byte --CT-- [5.10] DPT_Value_1_Ucount
162	SCENE: Output General 3 - Switch	This object will transmit the scene switch after the scene is called by the "SCENE: Control" object. The object will not be transmitted if it is disabled in parameters or if no value has been saved for the scene.	1 Bit --CT-- [1.1] DPT_Switch

14 Logic

The KNX MultiController includes three logic functions: bitwise logic, 1-byte comparator and timer function. See Figure 36 for the parameter window.

Bitwise logic:
- AND, OR, XOR or NXOR
- The output object will be updated based on the state for the two inputs
- The output can be filtered to only transmit when the output has changed.

Input 1	Input 2	Output AND	Output OR	Output XOR	Output NXOR
0	0	0	0	0	1
0	1	0	1	1	0
1	0	0	1	1	0
1	1	1	1	0	1

Comparator functions:
- 1-Byte highest, lowest, average
- 2-Byte highest, lowest, average
- The comparator output will transmit whenever one of the inputs are updated (no filter function for the comparator)

Timer function:
- The timer works as a staircase function with a reset time that can be set in parameters (in minutes).
- Reset time is settable via communication object.
- When the object "Staircase timer logic: In/out" is set, the timer will start and the object will be set to false after the timer duration has elapsed.

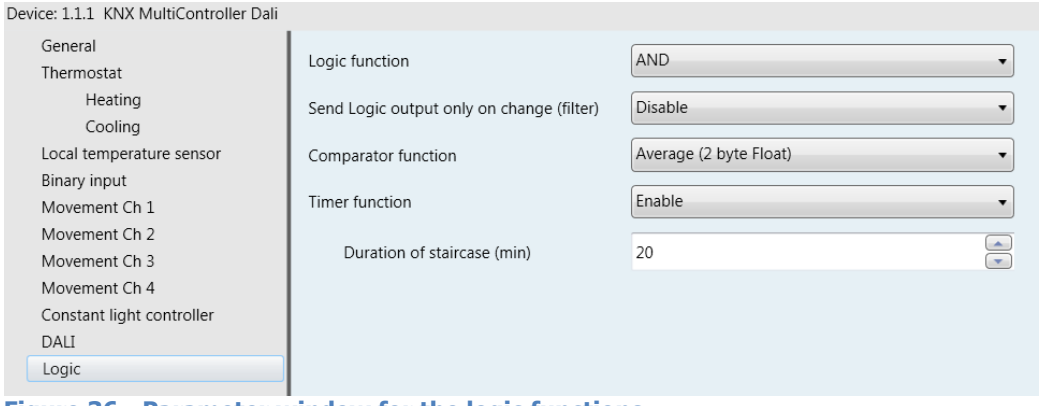


Figure 36 - Parameter window for the logic functions

14.1 Object list

Table 16 - Object list for the logic functions

Obj.	Object name	Description	Size, flags, DPT
126	Binary logic: NXOR Input 1	Input value 1 for NXOR logic function. Available if the NXOR logic function is selected.	1 Bit -WC--- [1.2] DPT_Bool
126	Binary logic: OR Input 1	Input value 1 for OR logic function. Available if the OR logic function is selected.	1 Bit -WC--- [1.2] DPT_Bool
126	Binary logic: XOR Input 1	Input value 1 for XOR logic function. Available if the XOR logic function is selected.	1 Bit -WC--- [1.2] DPT_Bool
126	Binary logic: AND Input 1	Input value 1 for AND logic function. Available if the AND logic function is selected.	1 Bit -WC--- [1.2] DPT_Bool
127	Binary logic: OR Input 2	Input value 2 for OR logic function. Available if the OR logic function is selected.	1 Bit -WC--- [1.2] DPT_Bool
127	Binary logic: XOR Input 2	Input value 2 for XOR logic function. Available if the XOR logic function is selected.	1 Bit -WC--- [1.2] DPT_Bool
127	Binary logic: NXOR Input 2	Input value 2 for NXOR logic function. Available if the NXOR logic function is selected.	1 Bit -WC--- [1.2] DPT_Bool
127	Binary logic: AND Input 2	Input value 2 for AND logic function. Available if the AND logic function is selected.	1 Bit -WC--- [1.2] DPT_Bool
128	Binary logic: NXOR Output	Result of the NXOR function based on the two input values. Available if the NXOR logic function is selected.	1 Bit R-CT-- [1.2] DPT_Bool
128	Binary logic: OR Output	Result of the OR function based on the two input values. Available if the OR logic function is selected.	1 Bit R-CT-- [1.2] DPT_Bool
128	Binary logic: XOR Output	Result of the XOR function based on the two input values. Available if the XOR logic function is selected.	1 Bit R-CT-- [1.2] DPT_Bool
128	Binary logic: AND Output	Result of the AND function based on the two input values. Available if the AND logic function is selected.	1 Bit R-CT-- [1.2] DPT_Bool
129	Comparator logic: Input 1	Input value 1 for the 1-byte comparator function. Available if one of the 1-byte comparator functions is selected.	1 Byte -WC--- [5.1] DPT_Scaling
129	Comparator logic: Input 1	Input value 1 for the 2-byte comparator function. Available if one of the 2-byte comparator functions is selected.	2 Bytes -WC--- [9.1] DPT_Value_Temp
130	Comparator logic: Input 2	Input value 2 for the 1-byte comparator function. Available if one of the 1-byte comparator functions is selected.	1 Byte -WC--- [5.1] DPT_Scaling

130	Comparator logic: Input 2	Input value 2 for the 2-byte comparator function. Available if one of the 2-byte comparator functions is selected.	2 Bytes -WC--- [9.1] DPT_Value_Temp
131	Comparator logic: Output lowest	Comparator output value for the lowest 1-byte value of input 1 and input 2. Available only if the "Lowest (1-byte)" comparator function is selected.	1 Byte R-CT-- [5.1] DPT_Scaling
131	Comparator logic: Output lowest	Comparator output value for the lowest 2-byte value of input 1 and input 2. Available only if the "Lowest (2-byte)" comparator function is selected.	2 Bytes R-CT-- [9.1] DPT_Value_Temp
131	Comparator logic: Output highest	Comparator output value for the highest 1-byte value of input 1 and input 2. Available only if the "Highest (1-byte)" comparator function is selected.	1 Byte R-CT-- [5.1] DPT_Scaling
131	Comparator logic: Output highest	Comparator output value for the highest 2-byte value of input 1 and input 2. Available only if the "Highest (2-byte)" comparator function is selected.	2 Bytes R-CT-- [9.1] DPT_Value_Temp
131	Comparator logic: Output average	Comparator output value for the 1-byte average value of input 1 and input 2. Available only if the "Average (1-byte)" comparator function is selected.	1 Byte R-CT-- [5.1] DPT_Scaling
131	Comparator logic: Output average	Comparator output value for the 2-byte average value of input 1 and input 2. Available only if the "Average (2-byte)" comparator function is selected.	2 Bytes R-CT-- [9.1] DPT_Value_Temp
132	Staircase timer logic: In/Out	Start the staircase timer by writing a "1" to this object. The object will transmit "0" when the staircase timer elapses.	1 Bit -WCT-- [1.2] DPT_Bool
133	Staircase timer logic: Change duration	Change the timer value for the Staircase function. The value is stored in volatile memory.	2 Bytes RWC-U- [7.005] DPT_TimePeriodSec

15 Behaviour after ETS download and bus reset

Function	KNX download, power failure and reset	Objects	Auxiliary power failure
Device: Self-Test status	Object transmitted	Obj. 0 Device: Self-Test status	Updated to TRUE
Mechanical relays	Unchanged	Not transmitted	Unchanged
Thermo outputs	Initially off	Not transmitted	Unchanged
Movement channels 1-4	Initially off	Not transmitted	Unchanged
Thermostat	Cyclic every 40 min and according to parameter	Obj. 4 Thermostat: Actual local temperature (sensor)	Unchanged
	Object transmitted at start-up	Obj. 8 Thermostat: Local adjustment of temp offset	Unchanged
	Object transmitted at start-up and according to parameter	Obj. 6 Thermostat: Base setpoint	Unchanged
	Object transmitted at start-up and according to parameter	Obj. 7 Thermostat: Actual setpoint	Unchanged
	Object transmitted at start-up	Obj. 14 Thermostat: Operation mode HVAC feedback	Unchanged
	Object transmitted at start-up, every 40 min	Obj. 15 Thermostat: Control value basic heating Switch	Unchanged
	Object transmitted at start-up, every 40 min	Obj. 18 Thermostat: Additional Heating	Unchanged
	Object transmitted at start-up, every 40 min	Obj. 19 Thermostat: Control value basic cooling Switch	Unchanged
	Object transmitted at start-up, every 40 min	Obj. 22 Thermostat: Additional Cooling	Unchanged
	Object transmitted at start-up (if automatic changeover enabled)	Obj. 23 Thermostat: Heating or Cooling status	Unchanged
Humidity	Object transmitted if change and cyclic according to parameter	Obj. 52 Humidity: Relative value	Unchanged
	Object transmitted if change and cyclic according to parameter	Obj. 53 Humidity: Limit switch	Unchanged
	Object transmitted if change and cyclic according to parameter	Obj. 54 Humidity: Dewpoint switch	Unchanged
	Initially "0"	Obj. 55 Humidity: External temperature for dewpoint	Unchanged
Dali broadcast	Object transmitted	Obj. 91 Dali broadcast: Switch status	Unchanged
	Object transmitted	Obj. 92 Dali broadcast: Value status	Unchanged
	Object transmitted if change	Obj. 98 Dali broadcast: Lamp fault	Unchanged
Dali group	Object transmitted	Obj. 102 Dali group 0: Switch status	Unchanged
	Object transmitted	Obj. 103 Dali group 0: Value status	Unchanged
	Object transmitted	Obj. 107 Dali group 1: Switch status	Unchanged
	Object transmitted	Obj. 108 Dali group 1: Value status	Unchanged
	Object transmitted	Obj. 112 Dali group 2: Switch status	Unchanged
	Object transmitted	Obj. 113 Dali group 2: Value status	Unchanged
	Object transmitted	Obj. 117 Dali group 3: Switch status	Unchanged
	Object transmitted	Obj. 118 Dali group 3: Value status	Unchanged
Dali Emergency	Object transmitted if change	Obj. 120 Dali emergency: Fault status	Unchanged
	Object transmitted if change	Obj. 121 Dali emergency: Duration of last test (min)	Unchanged
	Object transmitted if change	Obj. 122 Dali emergency: Battery charge (%)	Unchanged
	Object transmitted if change	Obj. 123 Dali emergency: Emergency status	Unchanged
	Object transmitted if change	Obj. 124 Dali emergency: Emergency mode	Unchanged
	Object transmitted if change	Obj. 125 Dali emergency: Emergency failure	Unchanged
Analog I/O VAV config	Output set to 0, not transmitted	Obj. 140 IOana 1: Output	Unchanged

	Object transmitted	Obj. 141 IOana 1: Feedback	Unchanged
	Output set to 0, not transmitted	Obj. 147 IOana 1: Output	Unchanged
	Object transmitted	Obj. 148 IOana 1: Feedback	Unchanged
Analog I/O 6-Way valve config	Object transmitted as 0% and output voltage set to 5V	Obj 140 IOana 1: Sequence 1 Cooling value Status	Unchanged
	Object transmitted as 0% and output voltage set to 5V	Obj 141 IOana 1: Sequence 2 Heating value Status	Unchanged
	Object transmitted as 0% and output voltage set to 5V	Obj 147 IOana 1: Sequence 1 Cooling value Status	Unchanged
	Object transmitted as 0% and output voltage set to 5V	Obj 148 IOana 1: Sequence 2 Heating value Status	Unchanged

16 Mechanical dimensions

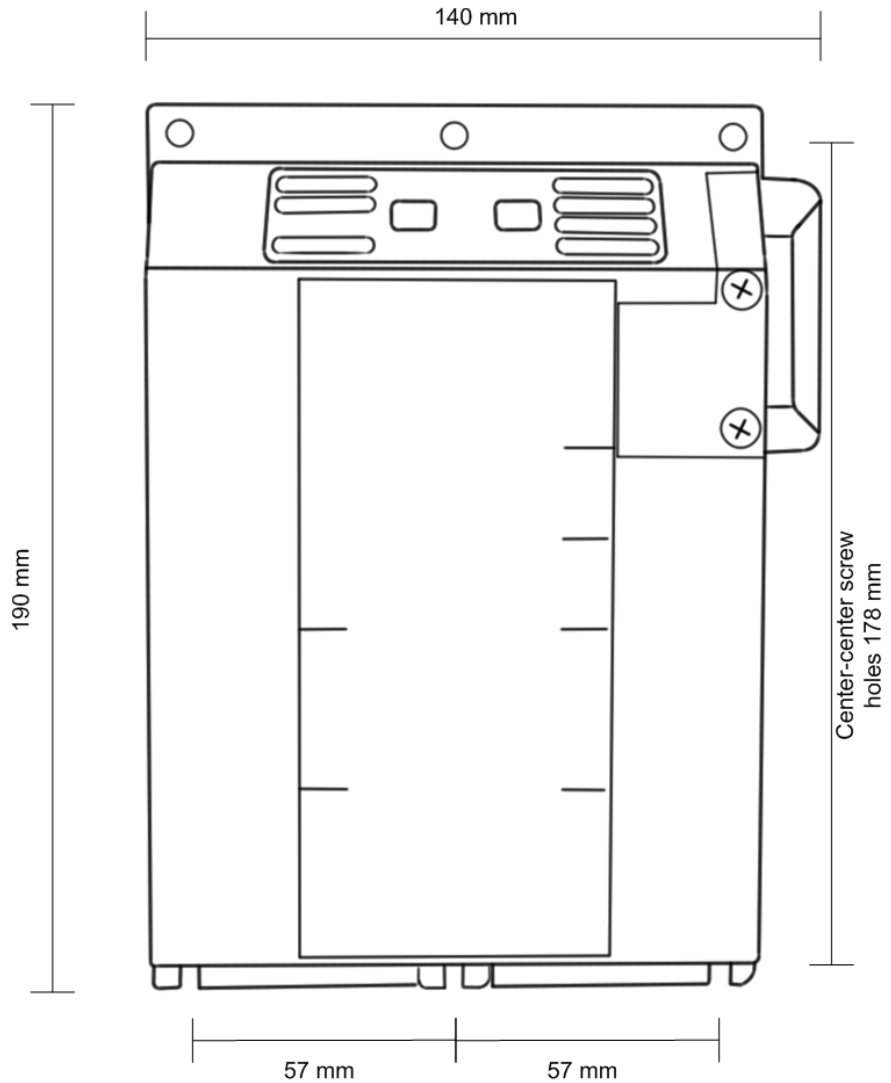


Figure 37 - Mechanical dimensions of the KNX MultiController (40 x 140 x 190 mm)

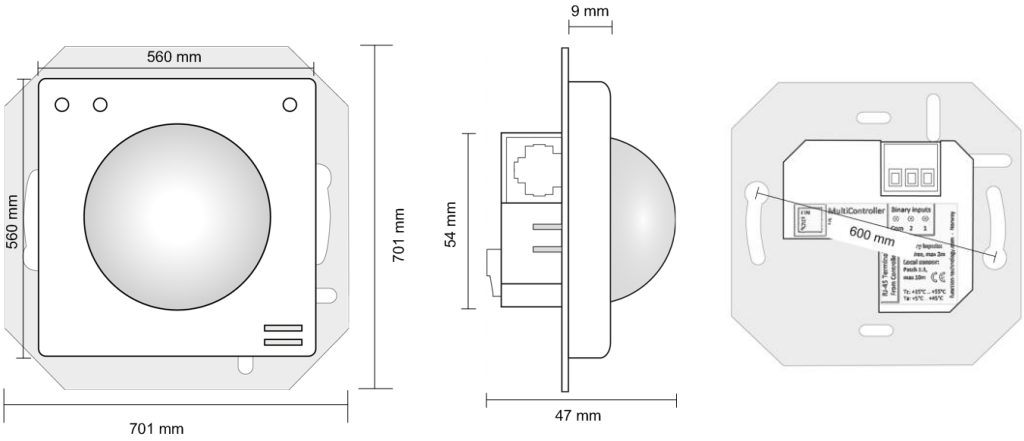


Figure 38 - Mechanical dimensions of the sensor (71 x 71 x 47 mm)

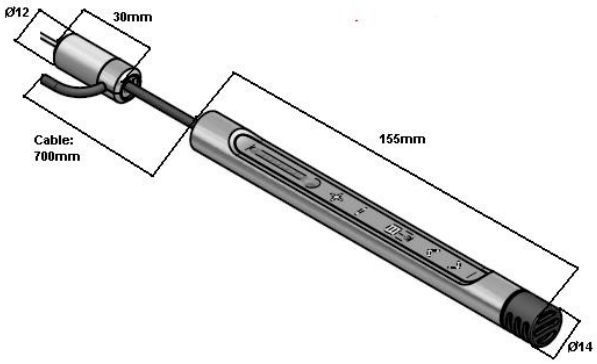


Figure 39 - Mechanical dimensions of Reed panel (155 x Ø14 mm)

Figure 40 - Mechanical dimensions of Reed Table (60 x 100 x 180 mm)

16.1 Detection area movement sensor (MC-S/MC-M)

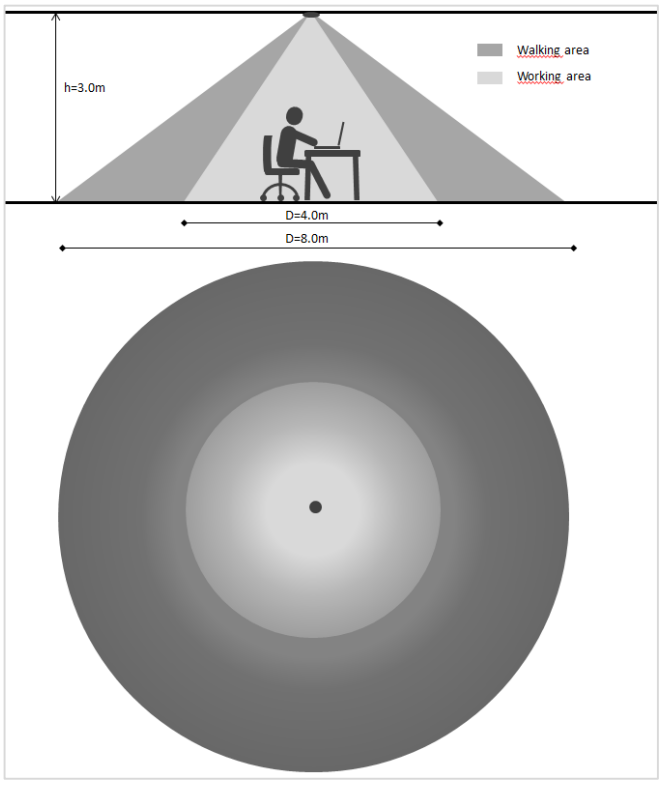


Figure 41 - Detection area for ceiling mounted sensor (520xx)

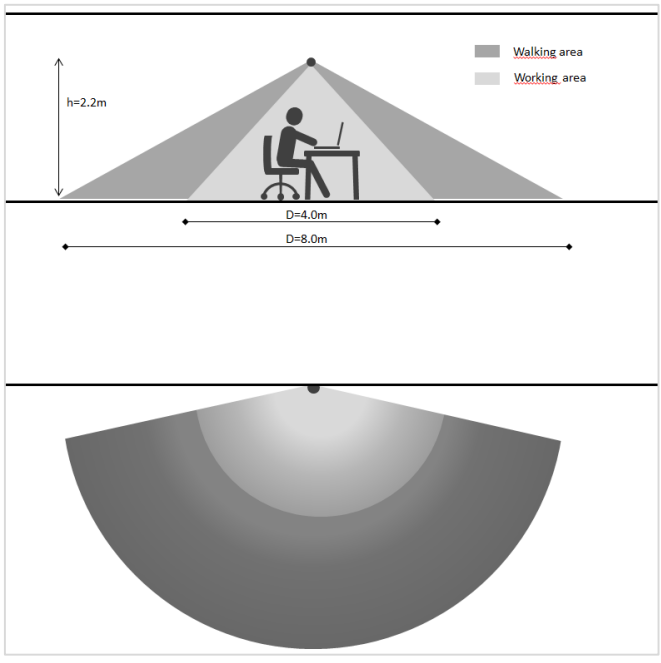


Figure 42 - Detection area for wall mounted sensor (520xx)

17 Connectors and mounting instruction

Product shown: KNX MultiController Dali 2x16 Wago

WAGO – DALI output
(12 EVGs and 4 groups)
Mates with plug:
WINSTA MIDI 5-Pole, Coding I

WAGO – 230V 16A output 2
Mates with plug:
WINSTA MIDI 3-Pole, Coding A

WAGO – 230V 16A output 1
Mates with plug:
WINSTA MIDI 3-Pole, Coding A

Terminal – 2x digital input (pot.free)

RJ45 – Local sensors (max length 10m)

WAGO – KNX supply
Mates with socket:
WINSTA KNX 2-Pole, Coding E

WAGO – 2x thermo output 230V
Mates with plug:
WINSTA MIDI 3-Pole, Coding B

WAGO - Main supply 230V
Mates with socket:
WINSTA MIDI 3-Pole, Coding A

Always mount a screw at the centre screw hole in the back to lock the KNX MultiController securely (see Figure 34)

Make sure the cables are not weighing down on the connectors, but mounted securely to the cable tray or mounting bracket with cable strips.

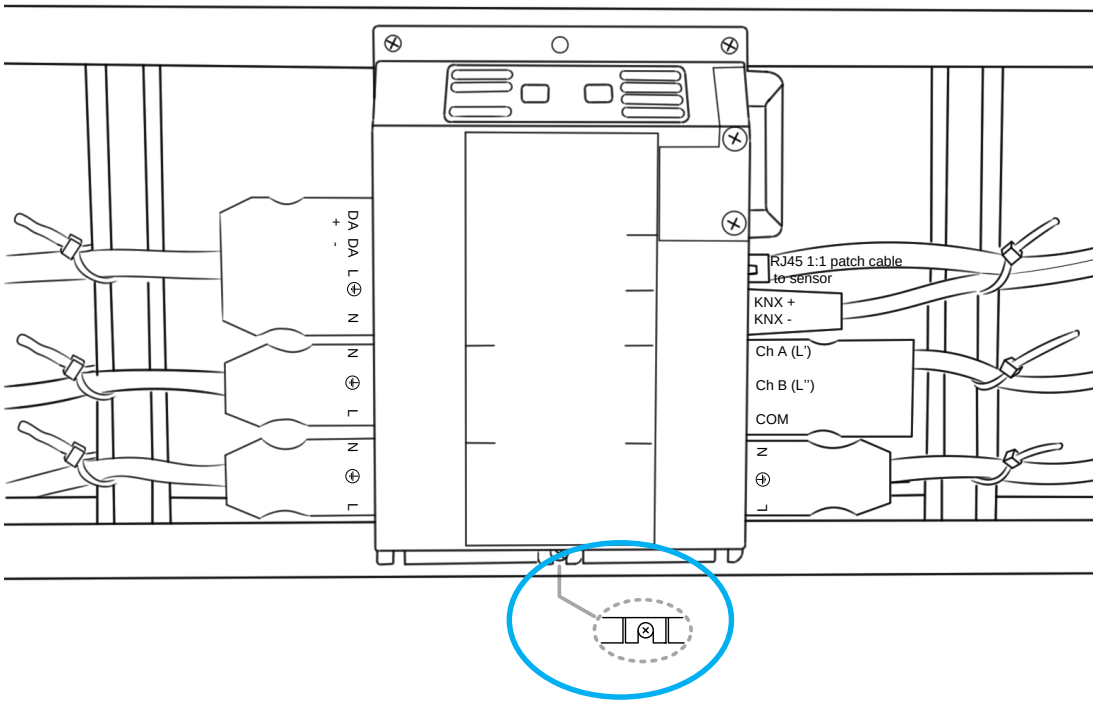


Figure 43 - Typical mounting of the MultiController (seen from bottom side)

18 Technical data

		KNX MultiController		
		54100/ 54110	54101/ 54111	54102/ 54112
Power	• Operating voltage, Main	230V AC 50Hz		
	• Operating voltage, KNX	21...30 V DC		
	• Power consumption, KNX	Normal 10mA / Peak 20mA		
Output relay	• Number of potential free contacts	–	–	–
	• Number of 230V outputs	–	1	2
	• Un rated voltage	–	–	–
	• In rated current	–	16A	
	• DALI output	Broadcast / 4 Groups		
	• Numbers of EVGs	12		
	• Power loss at max. load	4W		
Output relay switching power	• Max. inrush current Ip	–	400A/150µs	
	• AC3 operation (cosϕ=0.45) EN 60 947-4 -1	–	8A	
	• AC1 operation (cosϕ=0.80) EN 60 947-4 -1	–	16A	
	• DC current switching capacity (Ohmic load)	–		
	• Mechanical endurance	–	100.000	
Inputs	• Number of inputs	2		
	• Polling voltage Un	16V		
	• Sensing current In	1mA		
	• Permitted cable lengths	10 m		
Connections	• KNX	WAGO Winsta KNX / Wieland Gesis BST		
	• Load current circuits	WAGO Winsta MIDI / Wieland Gesis GST		
	• Inputs	Via connection terminal without screws		
	• Wiring	0.5-2.5 mm2		
	• Connection of local sensor	RJ45		
Movement detector	• Detection area at floor (diameter)	8 m		
	• Installation height	3 m		
Operating and display elements	• Through control panel in front			
Housing	• PC + ABS (antimony-, chlorine- and bromine-free flame retardant)			
KNX voltage	• SELV 29V DC (safety extra low voltage)			
DALI voltage	• ELV 16V DC (extra low voltage)	X		
Temperature range	• Operation	+5 °C ... +45 °C		
	• Storage	-25 °C ... +65 °C		
	• Transport	-25 °C ... +65 °C		
Design	• Dimensions (H x W x D)	40.0 x 130.5 x 190.0 mm		
Approvals	• EIB / KNX	Certification		
CE mark	• In accordance with the EMC directive 2005/108/EC and low voltage directive 2006/95/EC (tested according to EN50491-5-3:2010 and EN60730-1:2011)			

19 Revision history

25.01.2015 Rev. B: KNX MultiController FW1.3
Major changes
- New structure for the "General" ETS tab in chapter 3.1 General parameters
- Added reference to external lux sensor in chapter 5 Constant light controller
- Updated ETS menu figures and relay and binary input block diagrams
- Added chapter 12 Analog I/O
- Added chapter 13 Scene controller

25.03.2014 Rev. A: KNX MultiController FW1.2
Major changes:
- Added chapter 6 Infrared remote
- Added chapter 8.3.7 Additional continuous heating and cooling stage
- Updated datasheet

30.07.2013 Initial document: KNX MultiController FW1.0

Producer:
function Technology AS
Kanalveien 117b | N-5068 Bergen | Norway

Telephone: +47 55 38 50 80
Email: sales@function-technology.com
WEB: www.function-technology.com

Distributor: