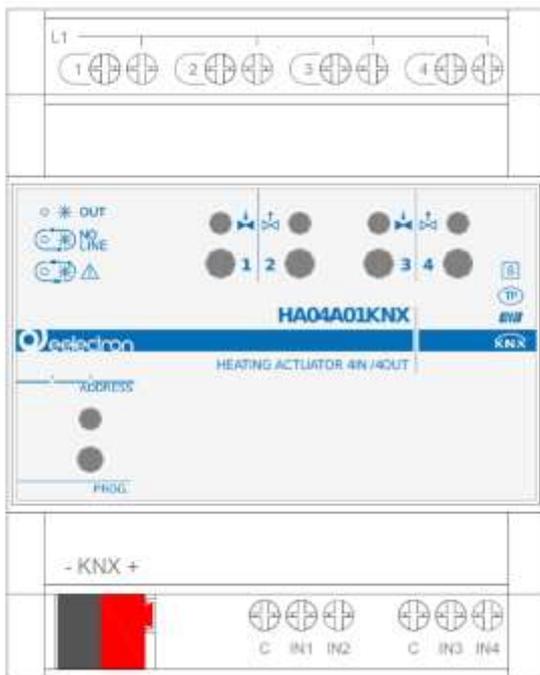


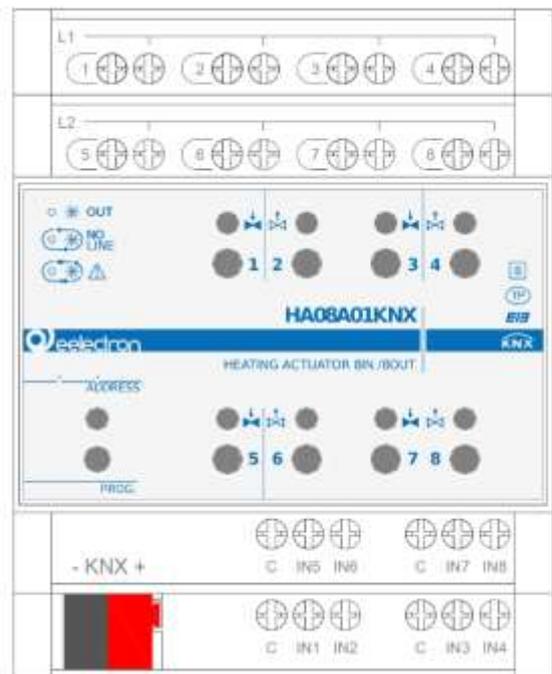
Product Handbook

HA04A01KNX	DIN Heating actuator 4 Inputs / 4 Outputs
HA08A01KNX	DIN Heating actuator 8 Inputs / 8 Outputs

Eelectron HA04A01KNX



Eelectron HA08A01KNX



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Any information inside this manual can be changed without advice.

This handbook can be download freely from the website: www.eelectron.com

Exclusion of liability:

Despite checking that the contents of this document match the hardware and software; deviations cannot be completely excluded. We therefore cannot accept any liability for this.

Any necessary corrections will be incorporated into newer versions of this manual.

Symbol for relevant information



Symbol for warning



DISPOSAL: The crossed-out bin symbol on the equipment or packaging means the product must not be included with other general waste at the end of its working life. The user must take the worn product to a sorted waste center or return it to the retailer when purchasing a new one. An efficient sorted waste collection for the environmentally friendly disposal of the used device, or its subsequent recycling, helps avoid the potential negative effects on the environment and people's health, and encourages the re-use and/or recycling of the construction materials

1. General introduction

This manual is intended for use by KNX® installers and describes functions and parameters of DIN modules HA04A01KNX and HA08A01KNX and how you can change settings and configurations using the ETS software tool.

HA08A01KNX and HA04A01KNX devices are EIB / KNX DIN rail actuators with 8 (4) Triac Outputs for electrothermal valves from 24V AC to 230V AC; they also include 8 (4) inputs for dry (potential-free) contacts. This manual refers to the HA08A01KNX module; all the features and functions described here are also applicable to the HA04A01KNX module except for those relating to the outputs and inputs that are not present in the 4 channels version.

2. Product overview

HA08A01KNX is designed to be installed in Home and Building installations (i.e. offices, hotels, private houses, etc...).

Main functions of outputs

The outputs can be configured as:

- 8 (4) channels for valve control in ON/OFF or PWM
- 4 (2) channels for 3-points valve control

Main functions of inputs

The inputs can be connected to pushbuttons, switches, or be configured as outputs (function related to input from 1 to 4 only) to activate individual signaling LEDs (see LED eelectron code LD00A01ACC / LD00A11ACC) and can be used for:

- 1-bit commands: loads activation / deactivation commands (ON / OFF / TOGGLE) with short pressure or with long and short pressure differentiation
- 1-byte commands (0-255 or HVAC commands or % value commands).
- Sending long action telegrams to the same short action address or to a different group address
- Commands for cyclic sending
- Sequences (3 commands that mix 1 bit / 1-byte objects) with different group addresses - in short and long press mode or in switching mode
- Dimmer management (with single button or with double button)
- Roller shutters and blinds management (with single button or with double button)
- Control sequences with 1 bit to manage switching on / off lights or rows of lights

- RGB color setting with fixed value (short pressure) or color change (long pressure); 1 byte datapoint or 3 byte selectable
- MUR / DND (Make Up Room - / Do Not Disturb), function with built-in logics
- Loop function between values to send step by step a sequence of values of 1 byte

Furthermore, 4 inputs (out of the 8 available) can be configured as analogue for the connection of NTC temperature probes in order to send 4 temperature measurements on the bus and manage a simple on / off control (e.g. towel-heater).

It is also possible to enable 4 complete thermostat modules; each thermostat module manages 2 stages with integrated PI controller for driving heating and cooling equipment and valves.

NTC probes:

For NTC temperature probe the following eelectron code accessories must be used:



TS01A01ACC (from -20°C to +100°C)

TS01B01ACC (from -50°C to +60°C)

NTC probes main functions:

Configured as temperature sensors (4 sensors) - main functions:

- 2 different temperature thresholds to activate alarms / warnings with 1-bit telegrams
- Enable / disable alarms / alerts via 1-bit objects

Configured as thermostats (4 thermostats) - main functions:

- Different Control Algorithms: 2-point on / off; PWM; continuous control
- Different modes of operation mode setting: Automatic HVAC / HVAC Manual / Setpoint
- Additional command for 2nd stage management
- Window contact management
- Additional external probe (optional)

3. Installation instructions

The device can be used for permanent internal installations in dry places and is intended for DIN rail mounting in LV distribution cabinets.



WARNING

- Device must be installed at a minimum distance of 4 mm between electrical power line (mains) and input cables or red / black bus cable.
- The device must not be connected to 230V cables

- The device must be mounted and commissioned by an authorized installer.
- The applicable safety and accident prevention regulations must be observed
- The device must not be opened. Any faulty devices should be returned to manufacturer
- For planning and construction of electric installations, the relevant guidelines, regulations, and standards of the respective country are to be considered.
- KNX bus allows you to remotely send commands to the system actuators. Do not lead to hazardous situations, and that the user always has a warning about which commands can be activated remotely.
- Before configuring the device using ETS, the output channels are configured as linked to manage 3-way valves in order to avoid improper control of this type of load. Frontal buttons are configured to switch the outputs with logical interlock.



WARNING

- Outputs are divided into 2 groups [1,2,3,4] and [5,6,7,8] - Each output of the same group must be connected to 24V AC or 230V AC; it is not possible to connect 2 different voltages on outputs of the same group!
- Outputs 1 and 5 must be used first, the other outputs cannot be used if the first output of that group is not connected: output 1 for group [1,2,3,4] and output 5 for group [5,6,7,8].

For further information please visit:
www.eelectron.com

4. Frontal led signalling

SYMBOL	STATUS	DESCRIPTION
 OUT	On/off	Out ON / OFF status
 NO LINE	Slow Blink	No Line
 	Fast Blink	Overcurrent or Line Error

No line:

KNX parameter is configured for 230V AC valves but voltage on channel 1 is not detected.

Overcurrent:

Connections problems on outputs or the number of connected valves is too high.

Line error:

The 230V AC voltage is detected but the KNX parameter is set to 24V AC: outputs are not activated.

5. General parameters

KNX PARAMETER	SETTINGS
Delay on Power up	3 ÷ 15 seconds
Through this parameter is possible to set the delay of transmission of telegrams after a power on by selecting the time by which the device is allowed to send telegrams. In large systems after a power failure or shutdown this delay avoids generating excessive traffic on the bus, causing slow performance or a transmission block. If there are different devices requiring sending telegrams on the bus after a reset, these delays must be programmed to prevent traffic congestion during the initialization phase. The input detection and the values of objects are updated at the end of the transmission delay time At the end of ETS programming the device behaves like after a power on.	
Local buttons	disabled/enabled
If this parameter is enabled, it is possible to activate the local relays by pressing the corresponding keys according to the configuration of the relays (single, coupled).	
Delay between simultaneous commutation [ms]	No delay; from 50 to 1500
Defines the delay to apply between two commutation of outputs; it is suggested to apply a delay to prevent the current peaks of each output from adding together.	
Economy mode: switch off leds after inactivity	Never switch OFF; 1 ..15 min.
It defines the behavior of the front leds, it is possible to set them to turn off after a few minutes when no manual action is performed on the local buttons.	
Thermal driving 1 - 4	24V / 230V
Thermal driving 5 - 8	24V / 230V
Outputs on the device are divided in 2 groups: 1-4 and 5-8. It is necessary to set correctly these parameter because every group can drive only one type of valves; 24V AC or 230V AC and these voltages cannot be mixed together. Different types of valves can trigger different alarms and for the proper functioning of the device the correct value must be set.	

6. Outputs

Outputs can be used individually or coupled; 4 combinations are allowed:

Parameter Value	Outputs
4 single outputs	1/2/3/4
	5/6/7/8
2 three points valves	1+2/3+4
	5+6/7+8
1 three points valve + 2 single outputs	1+2/3/4
	5+6/7/8
2 single outputs + 1 three points valve	1/2/3+4
	5/6/7+8

Single Output configuration is associated to the Electrival valve function.

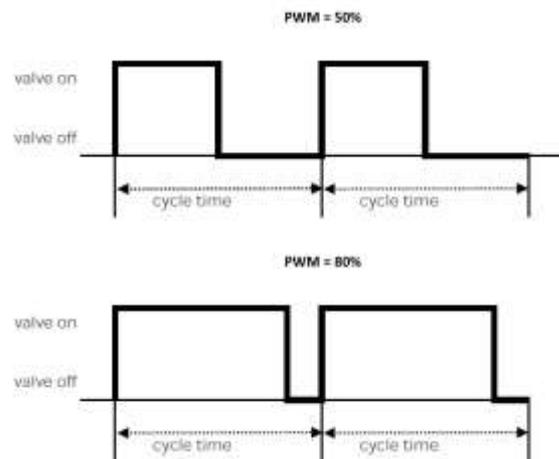
Three points valve configurations is associated to the servomotor function.

7. Electrical valve

Electric valve – general parameters

The Single-Output configuration allows to manage ON / OFF solenoid valves for heating / cooling systems. The open or closed output condition must be correctly associated with the open or closed valve condition as some valves, when energized, are open while others are closed.

The control of this type of valves can be ON / OFF through the 1-bit object <Output Ax | x> Open / Close or the 1 byte object <Output Ax | x> PWM %. The PWM control is used to avoid the temperature hysteresis typical of the ON / OFF control. The output operates the valve with the ON / OFF commands but performs a proportional control (0% ÷ 100%) based on the value received on the object <Output Ax | xx> PWM % modulating the pulse widths ON and OFF over time.



KNX PARAMETER	SETTINGS
Valve position when output not energized	open close
Defines the status of the valve when it's energized or not.	
Telegram for valve open	Telegram 0 Telegram 1
Defines the value of the telegram to open or close the valve	
Global all valve closed	Not subordinate Subordinate
Defines whether the output participate in the management of the global object <Global All> All valve closed.	
Cycle base time for PWM [min] (only for 1 Byte object)	5 .. 255
It defines the "cycle time" in which the actuator is activated at a time interval and then switched off again until the end of the cycle time.	
PWM lower limit value	0% ÷ 30%
Defines the minimum value received below which the valve is always closed.	
PWM upper limit value	70% ÷ 100%
Defines the maximum value received above which the valve is always open.	
Consider Opening Closing time for PWM	Do not consider Consider
Opening and closing is not instantaneous; time may vary from valve to valve according to manufacturer's characteristics and technology adopted. This parameter allow the programmer to set if the device must consider the opening time or the closing time when calculating the portion of cycle time associated to the open or closed state. It is suggested to consider those times if 10% of the cycle time is comparable to the opening or closing time.	
Time for opening	No delay / 15 s. to 10 min.
Time for closing	No delay / 15 s. to 10 min.
Set the opening and closing time for the valve, please refers to valve manufacturer's datasheet for the correct values.	
Lock Source	Do not use lock object Enable local lock object Enable global lock object Enable local and global lock objects
This parameter is to enable the lock function for the output; lock telegram may be received from the local	

object (1 for each output) or from the Global object (1 for each device)	
Feedback Source	Triac state KNX telegram
Each output may send a feedback for its status (open or close); if "Triac state" is selected the feedback is associated to the Triac state, if "KNX telegram" is selected the feedback is sent when a KNX telegram from an input connected to the valve contact reports the status of the valve.	
Extra time for valve opening [min]	0 .. 10
This time is the timeout time for waiting the KNX telegram associated to the valve input to be received (see previous parameter)	
Feedback state	disabled / enabled
Defines whether or not to send the status with a 1-bit object	
Feedback PWM%	disabled / enabled
Defines whether or not to send the status with a 1-byte object	
Anti lock function	disabled / enabled
It is possible to enable an automatic valve switching function, useful in case of long periods of inactivity, for example during the summer season. If this function is activated, it's possible to select how long the period of inactivity may last (refer to the "Anti-lock valve activation period" parameter); before the valve opens and after 5 minutes closes.	
Anti lock movement frequency	from 1 time per day up to 1 time every 16 days with granularity 1 day
Determines the maximum valve inactivity period before the anti-lock function is activated.	

The block function is activated / deactivated via the <Output Axx | object xx> Lock or the <Global All> Lock object

8. Three points valves

Three Points Valve – general parameters

This configuration associates 2 outputs for the management of 3-way valves.

The management of the 3-way valves is carried out using the coupled outputs: one executes the OPENING action and the other the CLOSING.

The parameters allow to set:

- The total opening / closing time
- The opening extra-time
- The closing extra-time
- The minimum pause time between 2 movements (same or opposite movements)
- The frequency of the anti-locking function
- The status sent on the bus

Through these 1 bit communication objects it is possible to set the position of the valve or of the servomotor

<Output Bx xx> Position 1	1 bit
<Output Bx xx> Position 2	1 bit
<Output Bx xx> Position 3	1 bit

As defined by parameters:

KNX PARAMETER	SETTINGS
Position 1	0% ÷ 100% (default 30%)
Position 2	0% ÷ 100% (default 65%)
Position 3	0% ÷ 100% (default 100%)

In the management of the 3-point valve there are many parameters already described in the previous paragraphs, refer to the management of the Electric Valve for their description.

9. Global Objects

The following communication objects are available for global functions:

OBJECTS RELATED TO ALL OUTPUTS	
<Global All> All Valve Closed	1 bit – On/Off CRT

Electric valve – lock function

When the lock function is enabled, the output can be switched to a defined state with a bus telegram and forced to keep this status even if it receives bus commands on other objects.

 When the lock function is active, local buttons are not enabled.

KNX PARAMETER	SETTINGS
Lock sources	Do not use lock object Enable local lock object Enable global lock obj. Enable local and global lock object
This parameter refers to the management of global objects. Do not use lock object Lock function is not used Enable local lock object The block function is activated / deactivated only via the <Output Axx object xx> Lock Enable global lock obj The block function is only activated / deactivated via the object the <Global All> Lock object Enable local and global lock object	

It is an object connected to both Electric Valve and Three point valve management; it is possible to subordinate them to the "All Valve Closed" function. This object considers the status of the valves and sends the value 1 if at least one valve is open and the value 0 if all are closed. in this way it is possible to give consent to the pump that supplies the hydraulic circuit.

<Global All> External Valve Closed	1 bit – On/Off CW
------------------------------------	---------------------

The "all valve closed" function can also consider the valve states on other HA04A01KNX or HA08A01KNX devices. It is enough to connect the "<Global All> All Valve Closed " output object of the other device to the "<Global All> External Valve Closed " communication object, in this way it is possible to connect "in cascade" more than two devices in order to have the information "all valves are closed or not" on the last communication object output and consequently drive the hydraulic pump correctly.

The input object can be enabled for a read request on power on to have a correct alignment of the data after a power down.

<Global All> Lock	1 bit – On/Off CW
-------------------	---------------------

This object can be used to manage the block function for multiple outputs and then to subordinate the different blocks to this global function

10. Inputs

Inputs are present on both HA04A01KNX and HA08A01KNX modules; each input can be set as digital input for dry contacts (potential free) and inputs number 1 to 4 can be set as output for signaling LEDs (see LED eelectron code LD00A01ACC / LD00A11ACC) or can be set as analog inputs for reading temperature probes:

IN	FUNCTION		
	DIGITAL INPUT	OUTPUT LED	TEMPERATURE PROBE
1	DIGITAL INPUT	OUTPUT LED	TEMPERATURE PROBE
2	DIGITAL INPUT	OUTPUT LED	TEMPERATURE PROBE
3	DIGITAL INPUT	OUTPUT LED	TEMPERATURE PROBE
4	DIGITAL INPUT	OUTPUT LED	TEMPERATURE PROBE
5	DIGITAL INPUT	-	-
6	DIGITAL INPUT	-	-
7	DIGITAL INPUT	-	-
8	DIGITAL INPUT	-	-

11. Digital input

With DIGITAL INPUT configuration each individual input can be configured to perform one of the following functions:

- Activation on press
- Activation on press / release
- Activation on short and long press
- Dimming
- Shutter and blinds
- Scene
- Command sequences (short and long press)
- Command sequences (toggle function)
- Command sequences 1 bit
- Set RGB color
- MUR/DND function
- Loop among values

KNX PARAMETER	SETTINGS
Function	Activation on press Activation on press / release Activation short and long press Dimming Shutter and blinds Scene Command sequences (short and long press) Command sequences (toggle function) Command sequences 1 bit Set RGB color MUR/DND function Loop among values

See following paragraph:

- Activation on press
- Activation on press / release
- Activation on short and long press
- Dimming
- Shutter and Blinds
- Scene
- Commands sequences
- Commands sequences (1 bit)

This function allows you to send sequences of 1-bit commands to multiple objects. The sequence can be defined on 2 or 3 objects. Each time the button connected to the input is pressed, the next step of the defined sequence is sent.

KNX PARAMETER	SETTINGS
Number of objects	2, 3
This set parameter defines the number of 1-bit objects that will be visible and that will send the values 0 or 1 on the bus	
Number of steps in the sequence	2 ÷ 8
Indicates the number of steps in the sequence.	

Long press to restart sequence	disabled/enabled
Allows to associate the long action of the button connected to the input with the restart action of the sequence at step zero	
Restart function	Restart and send first step
	Send long step and restart
Restart and send first Long press determines the sending of the step 1 Send long step and restart Long press determines the sending of the next step and brings the sequence to the initial step.	
Value step Long	<Different combinations of values of a,b,c objects>
Defines what happens when long press is performed (depends on "Restart function" parameter)	
Send only changed object	disabled/enabled
This parameter defines whether, in the passage from one step to the next, all the values associated with the one-bit objects must always be sent, or only those that change.	
Value step <x>	Combinations of on and off on 2 or 3 1-bit objects
Determines the combination associated with a sequence step using 2 or 3 1-bit objects.	
Set RGB color MUR / DND Loop among values	

Activation on press

"Activation on press" allows you to configure the sending of telegrams when the button is pressed; device can also be configured to send periodic messages with repetition period.

KNX PARAMETER	SETTINGS
Telegram Associated	1 bit / 1 byte
It is possible to send 1 bit or 1 byte objects	

Configurations for 1-bit object:

- On
- Off
- Toggle

Configurations for 1-byte object:

- Value 0-255 (generic signed int)
- Value 0-100% (scaling value in steps of 5%)
- HVAC Mode (DPT_HVACMode 20.102)

KNX PARAMETER	SETTINGS
---------------	----------

Cyclic sending when button pressed	Never
	0.3 s.
	0.4 s.
	0.5 s.
	0.8 s.
	1.0 s.
	1.2 s.
	1.5 s.
	2.0 s.
	3.0 s.
	5.0 s.
8.0 s.	
10 s.	
As long as the button is pressed, the telegram with selected size and value is sent cyclically; these parameters defines the time interval between two sendings	

Activation on press / release

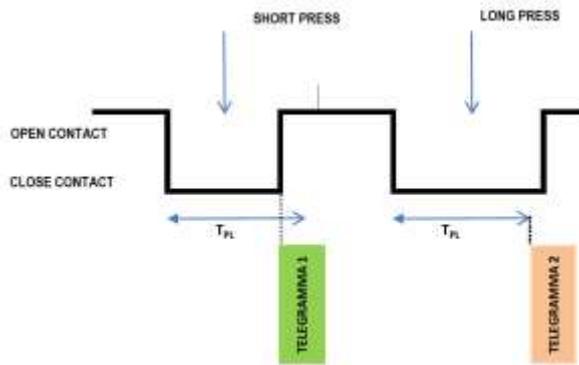
"Activation on press / release " allows you to configure the sending of telegrams when the button is pressed and when it is released. Parameters are identical to the choice "activation on press"; one parameter is added:

KNX PARAMETER	SETTINGS
Communication object on release	disabled / enabled
if enabled, this parameter displays an additional communication object (<Button x> Release Action) that is transmitted on the release event, this object can be associated with a group address other than the one that sends the value associated with the pressure.	

Activation on short and long press

The different duration between short and long press is defined by the parameter "Minimum time long press button".

You can set to send a telegrams with different values on short and long press or decide to send commands only on one of this events.



When button is pressed then counting time starts; if the button is released before time exceeds TPL time, device executes the command associated with the event of "short press" and if, on the contrary, TPL timeout expires and button is still pressed then the command associated with the event of "long press" is executed.

The parameters and mode of transmission of telegrams can be managed through "activation on long and short press" are the same set with the configuration "Activation of press / release " except for the function of cyclic sending that is not provided here.

Dimming

Through the dimming function it's possible to control a light dimmer using short and long press of the buttons.

Each button uses 2 communication objects:

1-bit dimension for ON /OFF command associated to short press operation

4-bit dimension for brightness regulation associated to long press operation

Parameter "Minimum time long press button" can set the minimum duration of long press; "Dimming mode" and "Dimming step" can define brighter or darker behaviour and step of each long press action.

Shutter and Blinds

Through the Shutter and Blind function, it's possible to control Roller Shutters or Blinds using short and long press of the buttons.

Each input uses 2 communication objects:

1 bit dimension for STEP /STOP command associated to short press operation

1-bit dimension for UP / DOWN command associated to long press operation

Parameter "Minimum time long press button" can set the minimum duration of long press; "Command

drive shutter" can define up or down behaviour associated to long press action.

Scene

In this configuration page it's possible to set the button for scene management: learn and recall scene commands.

These different behaviour (recall and learn) are performed through two different actions (short and long press) of the button.

Learn scene on long press action is enabled by a parameter; "Minimum time long press button" can set the minimum duration of long press.

KNX PARAMETER	SETTINGS
Scene Number	Number of the scene: 0 ÷ 63
This parameter sets the value of the scene you intend to learn / recall (one per channel). Remember that output devices (i.e. actuators, etc.) generally can manage several scenes, each identified by a value (that varies from 0 to 63); therefore is important to set this parameter correctly and matching the number set on the actuators.	
Store scene on long press	disabled / enabled
If disable, long press action is ignored and no telegram is sent to the bus; if enable on long press action a learn scene telegram is sent to the bus.	
Object enable scene learning from bus	disabled / enabled
If this parameter is enabled you have a communication object (size = 1 bit) in order to enable / disable runtime from bus the sending of the "learn scene telegram". When this object receives a telegram "1" then the function associated to the long press of the button (send the telegram storage scenario) is enabled, when it receives a telegram "0" the command associated with the long press is not sent.	

Commands sequences

This function allows you to associate to short and long press, sequences of different commands on the bus.

For each button this function is available for short and long press or as toggle function.

The sequence consists of 2 or 3 commands which can each be sized as 1 bit or 1 byte.

Once defined the number of elements in the sequence (2 or 3) and their size (1-bit / 1 byte), you can associate different commands to each element of the sequence or decide to send commands only on one of the two events.

The waiting time between a command and the next is fixed in 1 second.

Each object communication can be connected to a different group address.

For example it is possible to define a sequence:

obj	dimension	short press (operation 1)	long press (operation 2)
A	1 bit	ON (to actuators)	OFF (to actuators)
B	1 byte	100% (to a dimmer)	0% (to a dimmer)
C	1 byte	COMFORT (to a thermostat)	ECONOMY (to a thermostat)

Commands sequences (1 bit)

This function allows you to send sequences of 1-bit commands to multiple objects. The sequence can be defined on 2 or 3 objects. Each time the button connected to the input is pressed, the next step of the defined sequence is sent.

KNX PARAMETER	SETTINGS
Number of objects	2, 3
This set parameter defines the number of 1-bit objects that will be visible and that will send the values 0 or 1 on the bus	
Number of steps in the sequence	2 ÷ 8
Indicates the number of steps in the sequence.	
Long press to restart sequence	disabled/enabled
Allows to associate the long action of the button connected to the input with the restart action of the sequence at step zero	
Restart function	Restart and send first step
	Send long step and restart
Restart and send first Long press determines the sending of the step 1 Send long step and restart Long press determines the sending of the next step and brings the sequence to the initial step.	
Value step Long	<Different combinations of values of a,b,c objects>
Defines what happens when long press is performed (depends on "Restart function" parameter)	
Send only changed object	disabled/enabled
This parameter defines whether, in the passage from one step to the next, all the values associated with the one-bit objects must always be sent, or only those that change.	
Value step <x>	Combinations of on and off on 2 or 3 1-bit objects

Determines the combination associated with a sequence step using 2 or 3 1-bit objects.

Set RGB color

This function allows you to associate a short press of the button to a command on the bus in order to set a RGB color. The "RGB object type" parameter defines whether the command is sent with a single 3-byte object or 3x1-byte objects. It is also possible to enable a feature associated with a long press that allows to change the color which is sent with a short press. During long press the color transition is performed and at the time of release the selected color is stored; this means that from now every time a short press is done the new color is sent on the bus. When the device is powered off and on the last selected color is kept in memory. The "Enable sending color during transition" option allows you to send all color transitions during long press so that each color can be displayed on another device.

MUR / DND

This function allows you to configure a input to send 1-bit commands with DND (do not disturb), MUR (make up room) or reset both signals - according to the sequence described below.

Value of parameter "command associated" (column "cmd") defines which values are sent on the 2 x 1 bit objects

cmd	Action	DND	MUR	Note
MUR	enable	0	1	MUR co sends "1" DND co sends "0"
MUR	disable	-	0	MUR co sends "0"
MUR	toggle	MUR enable/disable alternate		
DND	enable	1	0	DND co sends "1" MUR co sends "0"
DND	disable	0	-	DND co sends "0"
DND	toggle	DND enable/disable alternate		
Loop		0	1	Loop among these 3 sets
		1	0	
		0	0	

It is possible to associate a color to each of the 3 states (DND active, MUR active, MUR & DND not active); it's also possible to send the same color on the bus using a 3Byte Object DPT 232.600 RGB value 3x(0..255)

Loop among values

With this function you can configure a button to send a 1-byte value in sequence. The sequence is composed of a number of values between 3 and 9. Each time a pressure (or release according to the "active edge" parameter) is done a value is sent following the order set in ETS: from the first (A) to the last (I).

Two objects are available:

<Input x> Loop Value Output	1 byte – 0..255 CW
This object is to send the values of the sequence	
< Input x> Loop Value Feedback:	1 byte – 0..255 CRT
this object is to receive a value from the bus; if it corresponds to a value set in the sequence it bring the same to the corresponding step.	

12. Led output

Each input configured as LED output can be connected to a LED (see LED eelectron code LD00A01ACC / LD00A11ACC) and configured as:

Always OFF	Led is OFF
Always ON	Led is ON
Bus controlled	Led is lit on or off upon the telegram receive from bus ; initial state and led behaviour (fixed or blink) can be configured

13. Analog Inputs

For inputs 1, 2, 3 and 4, if configured as analog inputs for temperature probe, the NTC probes code eelectron must be used:



TS01A01ACC (da -20°C a +100°C)
 TS01B01ACC (da -50°C a +60°C)

Maximum connection cable length: ≤ 30 m (twisted cable)

TS01A01ACC

Dimensions in millimetres
 NTC resistance tolerance: ± 3%
 Measure range: -20°C ÷ +100°C
 Cable: 2 wire single insulation
 Cable colour: Black
 NTC colour: Black
Warning: keep at least 6 mm from all live parts

TS01B01ACC

D1 = 9 mm D2 = 4 mm L2 = 49 mm L1 = 1250 mm
 NTC resistance tolerance: ± 2%
 Measure range: -50°C ÷ +60°C
 Cable: 2 wire double insulation
 Cable colour: White
 NTC colour: White
Warning: keep at least 3 mm from all live parts

For a each analog input a temperature function can be set: Temperature Sensor Function or Thermostat Function.

14. KNX probe temperature object.

It is possible to enable the reading of a second external probe which sends the measurement data to the thermostat via the communication object ADDITIONAL TEMPERATURE of size 2 bytes.

Surveillance time for KNX probe	10..255 (min)
Whenever the thermostat receives a valid data from KNX probe it consider this value in the calculation of the	

measured temperature and reset the internal time (monitoring time).

If KNX probe is enabled the monitoring time is used to check if the additional temperature sensor periodically sends valid data to the thermostat. This mechanism avoids to consider as valid some data which can be old hours or days, for example if the additional sensor should fail or the thermostat could not receive data for long time.

It is **strongly recommended** to set a value for surveillance time of the additional sensor **more than twice** of the period set for the cyclical sending of the additional sensor.

15. Temperature Sensor

Analog inputs can be set as Temperature Sensors with the following parameters and communication objects.

Temperature Sensor – parameters

KNX PARAMETER	SETTINGS
Activation telegram	Telegram 0 Telegram 1
Defines which telegram value enables sending of the threshold on / off telegrams.	
State after download	Disabled / enabled
Defines whether the sending of the threshold on / off telegrams is enabled or disabled after download.	
Hysteresis	0.5°C 1.0°C 2.0°C 5.0°C
Defines the hysteresis value to be applied on the high and low thresholds	
Upper Setpoint value	-20°C ÷ +100°C TS01A01ACC -50°C ÷ +60°C TS01B01ACC
Lower Setpoint value	-20°C ÷ +100°C TS01A01ACC -50°C ÷ +60°C TS01B01ACC
Telegram when value is below setpoint	off / on / nothing
Telegram when value is above setpoint	off / on / nothing
Cyclic sending time of telegrams	No cyclic sending 30 min 1 hour 2 hours

Temperature Sensor – Com. Objects

<Temperature x> Actual Temp.	2 bytes CRT
Send temperature measurement in °C on variation and / or cyclically.	
<Temperature x> KNX probe Temp.	2 bytes CW
The measurement of another probe is received via KNX	

<Probe x> Setpoint Upper	2 bytes CW
Receives the upper setpoint via KNX bus	
< Probe x> Telegram Upper	1 bit CRT
Send On, Off or nothing when going up or down the set upper threshold	
< Probe x> Setpoint Lower	2 bytes CW
Receives the lower setpoint via KNX bus	
< Probe x> Telegram Lower	1 bit CRT
Send On	
< Probe x> Enable Input	1 bit CW
Enables or disables the sending of on / off telegrams	

16. Thermostat Function

The temperature function can be configured as a thermostat to control the temperature of a room or area by driving heating or cooling equipment / valves or through commands on / off to heating / cooling elements such as radiators, heat pumps, split, etc. ...

Thermostat operates temperature in a range from -9.9 ° C to + 99.9 ° C with 0.1°C resolution.

Setpoint values (including SETPOINT MODE) from the bus are accepted in a range from 10°C to 50°C

Target Setpoint Settings

The control setpoint can be changed by bus in two different ways, via one of these objects:

HVAC Mode
SETPOINT Mode

The right policy to adopt depend from the device that acts as a master, a time thermostat, a control panel or a SW supervisor. Here the list of object for changing the active mode or setpoint value by bus.

SETPOINT Object

When "Thermostat control mode" parameter is selected with the value SETPOINT MODE, object HVAC Mode is no longer visible.

Each time the thermostat receives a value on object SETPOINT MODE (2 byte size), it is used as setpoint for temperature control.

HVAC MODE obj. (switched heat / cool)

Using the HVAC MODE object (size 1 byte), it is possible to set the thermostat in one of the following modes: OFF; ECONOMY; STANDBY; COMFORT; each

mode is associated with a setpoint set by an ETS parameter.

OFF mode is associated with the antifreeze setpoint in heating mode and at the high temperature protection set point in cooling mode.

HVAC MODE obj. (automatic heat / cool)

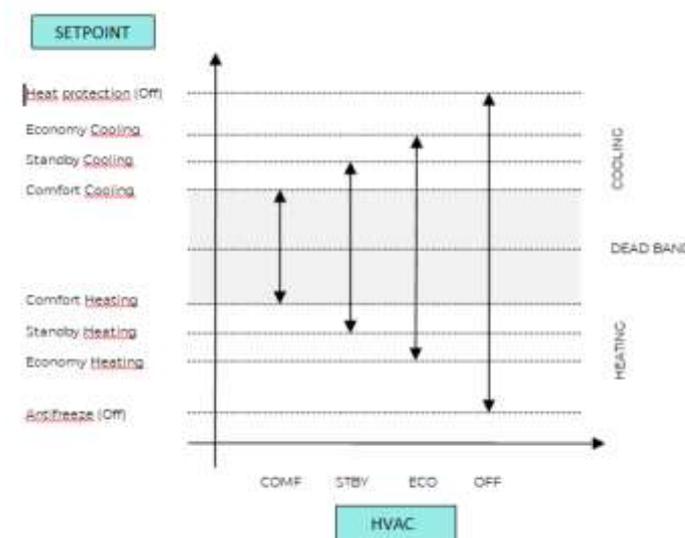
Behaviour for this value of parameter "Thermostat control mode" is the same as above described but the switching from heating to cooling mode and vice versa is automatic. With this setting it is necessary to set an insensitive zone as in parameter "Dead zone".

Whenever temperature becomes greater than : $Setpoint\ comfort\ heating + (Dead\ Band / 2)$ active control is cooling; when temperature becomes less than: $Setpoint\ comfort\ cooling - (Dead\ Band / 2)$ active control is heating.

HVAC MODE obj. (automatic heat / cool)

Behaviour for this value of parameter "Thermostat control mode" is the same as above described but the switching from heating to cooling mode and vice versa is automatic. With this setting it is necessary to set an insensitive zone as in parameter "Dead zone".

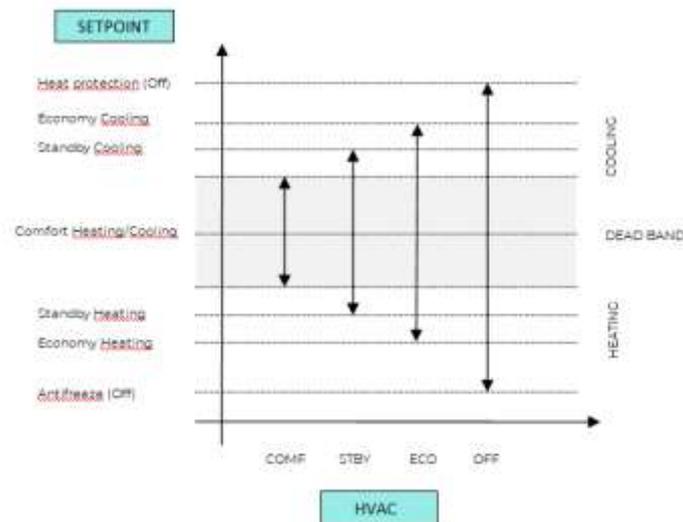
Whenever temperature becomes greater than : $Setpoint\ comfort\ heating + (Dead\ Band / 2)$ active control is cooling; when temperature becomes less than: $Setpoint\ comfort\ cooling - (Dead\ Band / 2)$ active control is heating



It is possible to set the comfort setpoint as the center of the dead band using the relative parameter; the

comfort value is common to the heating and cooling mode.

KNX PARAMETER	SETTINGS
Comfort setpoint	Setpoint H/C Dead band center



SETPOINTCOMFORT,STANDBY,ECONOMY

These 2 byte objects are used to set the setpoint values for COMFORT, STAND-BY, ECONOMY mode. Whenever change, the setpoint are in saved in memory.

After download these setpoint are reset to values according to ETS parameter; on power up these object are set according to last values before power down.

Use these communication objects to change current setpoint for every HVAC Mode according to the current active control (heating or cooling)

KNX PARAMETER	SETTINGS
Action to execute for setpoint	modify relative modify absolute
If you set this parameter to " modify relative ", the thermostat will take into account the new value set but will still consider the setpoint set in ETS as a reference to determine the allowed variation range ($\pm 1, \pm 2, \pm 3, ..$); choosing instead the value "absolute change" also this range will be recalculated.	

COMFORT Object

COMFORT object (1 bit size) is visible only when "Thermostat control mode" parameter is selected with the value HVAC MODE.

When a telegram "1" is received thermostat goes in COMFORT mode (it applies for both heating and cooling)

On receipt of a telegram "0", thermostat returns to the mode set by HVAC MODE object.

COMFORT mode can be set also with timing: after a time set by a parameter thermostat returns in the previous mode.

KNX PARAMETER	SETTINGS
Comfort Object	Time limited Time unlimited
Comfort Overwrite Time	1.. 255 (minutes)

Object ENABLE HEATING/COOLING

This object is present only in HVAC Mode automatic. If enabled, it allows you to enable or disable the heating or cooling mode.

Enable Object	Cooling / Heating
Allows you to select which mode you can enable / disable	
State after download	disabled/enabled
Determines whether after download the selected mode in the previous parameter is enabled or disabled.	
Activation telegram	telegram "0"/"1"
Telegram to enable Cooling / Heating mode.	

Object LOCK HEAT/COOL

This object is present only in automatic mode. If enabled, it allows you to lock the heating or cooling mode in the current state.

Lock Telegram	telegram "0"/ telegram "1"
Telegram to block the mode.	

WINDOW CONTACT Object

This object, if enabled, has higher priority than HVAC MODE, SETPOINT MODE, COMFORT objects.

When a telegram is received ("0" or "1") on the communication object WINDOW CONTACT thermostat enters a power saving mode:

BUILDING PROTECTION (if running in HVAC MODE) or Setpoint antifreeze /high temperature protection (if running in SETPOINT MODE)

If the telegram received indicates that the window is opened, thermostat change its mode or setpoint after 1 minute from the reception of the telegram.

When it receive a telegram corresponding to state "window closed" it restores the previous mode, always with a delay of 1 minute. The value of SETPOINT ADJUSTMENT (if enabled) is always restored.

SETPOINT ADJUSTMENT object

The object SETPOINT ADJUSTMENT allows you to temporarily change the setpoint value used by the thermostat applying an offset to the current value.

If the thermostat is operating in "HVAC MODE" the offset value is applied from the time of receipt of a valid telegram on object SETPOINT ADJUSTMENT until this value does not change, even in case of change of the active mode (Comfort and Standby); when device enters Economy mode this value can be reset or not according to the parameter "Reset delta setpointon HVAC economy). Entering Building Protection mode the value of object SETPOINT ADJUSTMENT is forced to 0.

Similarly, if the thermostat is operating in SETPOINT MODE the offset value is applied also when the setpoint value received on this object changes.

ACTUAL SETPOINT object

The ACTUAL SETPOINT object send the setpoint in use and is sent every time:

- The value of HVAC mode object changes
- The value BASE SETPOINT changes
- The value of SETPOINT ADJUSTMENT object changes
- After download
- One minute after power on

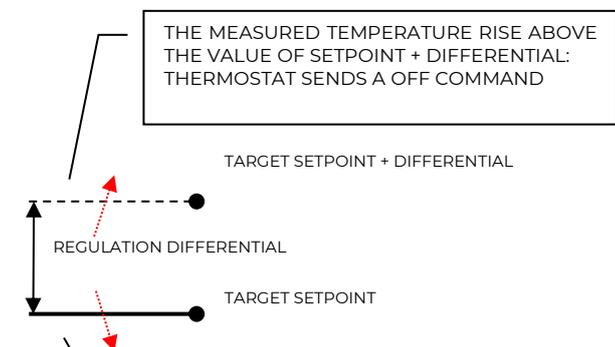
Two points on/off

Control algorithm "2 points on / off" is used to control heating or cooling elements that can be controlled by switching on and off of the same elements, radiators, under floor heating with on-off valves, boilers, etc. ..

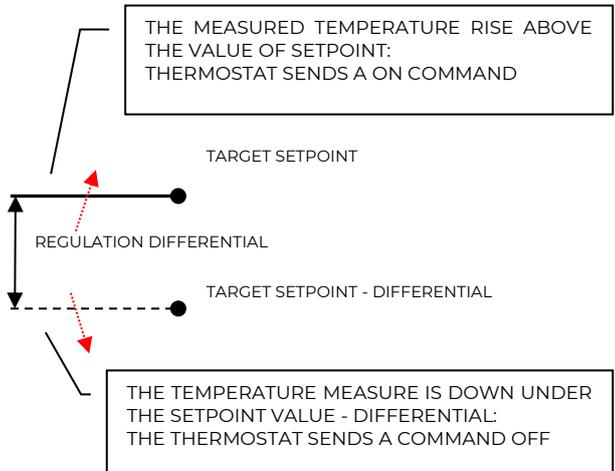
When the thermostat switches to "winter mode" (heat mode) sends a off command on object ON/OFF COOLING and operates the control only through the object ON/OFF HEATING (the object ON/OFF COOLING is therefore not updated anymore until it returns in "cooling mode").

Therefore, in the transition from " winter" to "summer" mode sends a off command on ON/OFF HEATING commands and activates the control through the object ON/OFF COOLING

on/off control in heating mode:



on/off control in cooling mode:



Integral proportional control PWM

Integral proportional control with PWM is an algorithm that reduces the effects of hysteresis around the set point value by adjusting the controls on the values ranging from 0% to 100% where 0% means "control off" and 100% means "maximum control action".

Once a cycle time is defined the thermostat sets the actuator to ON for a fraction of the cycle time and OFF for the remaining part. Driving the actuator with the control value of 80% means that it is active (i.e., ON) for 80% of cycle time and OFF for the remaining 20%

KNX PARAMETER	SETTINGS
Cycle time (TCp)	10, 20, 30, 60 min

Defines the time interval.	
Proportional band (Bp)	1, 2, 3, 4, 5 °C
The proportional band BP is a range of temperatures between "Setpoint" and "Setpoint-Bp" in heating mode and between "Setpoint" and "Setpoint+Bp" in cooling mode, within this interval thermostat controls the temperature using the proportional algorithm; outside it drives actuator always in ON or OFF. When temperature is inside this range device wait the end of the cycle time before calculating the duty cycle of the next cycle. When temperature is outside of this range : below "Setpoint-Bp" in heating mode or above "Setpoint+Bp" in cooling mode it starts a new cycle as soon as temperature enters the Bp	
Integration time (Ti)	5 .. 250 min
Defines the integration time	

Integral proportional contr. continuous

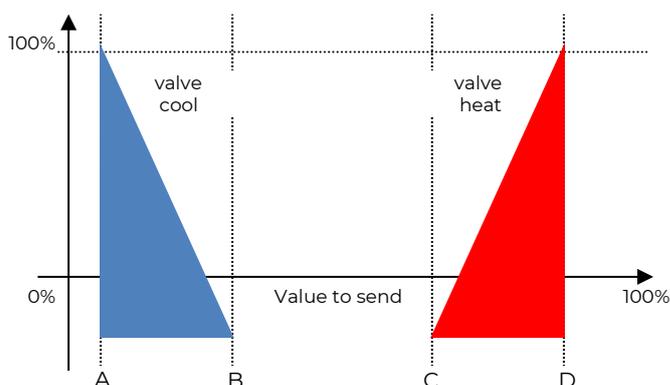
This setting is very similar to "Integral proportional control with PWM" in terms of algorithm and parameters. This mode uses a 1 byte object (% value) to send the command on the bus .

Additional valve

This function is used when the thermostat has to manage 2 different systems, one in heating and one in cooling. The additional valve can be configured to manage a PI control, a PI control with PWM, a 6-way valve.

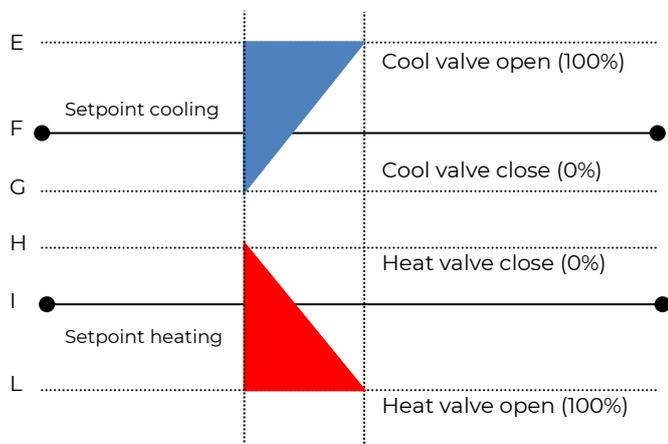
Additional valve 6 ways

The additional valve manages commands for 6-way valves in which the control value from 0% to 100% defines both the percentage of valve opening and the passage of hot or cold fluid.



KNX PARAMETER	SETTINGS
Percentage 100% cool	0% ÷ 30%
Value to be sent to bring the cold valve to 100% open position [point A on the diagram]	
Percentage 0% cool	23% ÷ 53%
Value to be sent to bring the cold valve in closed position (0% open) [point B of the diagram]	
Percentage 0% heat	47% ÷ 77%
Value to be sent to bring the hot valve to the closed position (0% open) [point C of the diagram]	
Percentage 100% heat	70% ÷ 100%
Value to be sent to bring the hot valve to 100% open position [point D on the diagram]	
Value to send for valve fully closed	36% ÷ 66%
Value to be sent to bring both the cold and hot valves to the fully closed position. [area of the diagram between B and C]	

For the additional valve, in 6-way mode, it is possible to define different control differentials around the setpoint value as shown below:



This makes it possible to adjust the opening and closing of the additional valve independently of the speed control (for example, once the setpoint has been exceeded, a maintenance action can be taken keeping the valve open again without activating the speeds)

KNX PARAMETER	SETTINGS
Regulation differential valve 0%	0°C ÷ 5 °C
Defines the width of the F-G bands for cooling and H-I for heating	
Regulation differential valve 100%	0°C ÷ 5 °C
Defines the width of the E-F bands for cooling and I-L for heating	

2nd Stage Object

The 2nd Stage object is an additional control object for the regulation of a second heating or cooling equipment; a 1-bit or 1-byte control can be set for this object; if the control is a byte it is possible to set PI control (Proportional Integral). With the "Bandwidth" parameter you set how much the current setpoint is shifted to manage the switching on and off of the equipment controlled by the 2nd stage object. For example, if the setpoint is 20 ° C and "Bandwidth" is set = 1 then the setpoint for the part controlled by the 2nd stage object will be 20-1 = 19 ° C; vice versa if "Bandwidth" is = -1 then the 2nd stage setpoint will be 20 - (- 1) = 20 + 1 = 21 ° C.



If the equipment controlled by 2nd Stage is a 1,2 or 3-speed fan coil it is suggested to set the 2nd stage as 1 Byte and to send the control value % in the logic called "proportional speed/fancoil conversion" to have 1 bit output objects for the 3 speeds.

Temperature probe failure / out of range measurement



If the temperature probe is disconnected or in short circuit the control action is interrupted and the controlled actuators are switched off.



The value of temperature sent on the bus in case of probe disconnection or short circuit or for out of range measured value is 0 °C (according to KNX DPT_Value_Temp 9.001)

Temperature alarm object

Alarm objects are available for each thermostat and for each temperature probe; in case of probe failure or out of range measurement, a telegram with value "1" is sent to the bus on a 1-bit communication object; as soon as the temperature sensor is operating again, the value "0" is transmitted.

To correctly manage the internal or rear sensor or KNX sensor via bus, refer to the following configuration modes:

CONFIGURATION MODE 1
Only probe connected to input
if the temperature probe is disconnected or short-circuited, the monitoring action is interrupted, and the controlled actuators are deactivated.
probe / short circuit disconnection / out of range measurement:
Obj "Temperature" is not send
Obj "Alarm" send "1"

CONFIGURATION MODE 2
Only KNX temperature via bus
The KNX probe is read considering the last value received on the Obj "KNX probe temperature".
If the KNX probe value is out of range or the monitoring time expires: Obj "Alarm" send "1" until KNX temperature is received again.

CONFIGURATION MODE 3
Mix of probe connected to input and KNX temperature via bus
The KNX probe is read by considering the last value received on the OBJ "KNX temperature probe".
The value of the temperature sent on the bus is the weighted average between the values of the front probe and KNX.
If the value of the KNX probe is out of range or the monitoring time expires without having received any message, the thermostat starts by considering only the other probe until it receives a new valid value from the KNX probe; in this case the bus value is again considered.

17. Thermostat behaviour on bus failure, recovery and download

Behaviour on bus voltage failure

On failure of bus voltage, no actions are executed by the device; behaviour of controlled actuators must be set using their own parameters.

Behaviour on bus voltage recovery

On bus voltage recovery all the communication objects are set to 0 except for objects for which a parameter is defined for the initial value; thermostat keeps these values in memory and restore them after recovery:

- Heat / Cool mode
- HVAC Mode
- Base Setpoint
- Setpoint Adjustment
- Force value in manual mode
- Ventilation

Control values (i.e. commands to actuators) are calculated using actual setpoint and temperature.

 After power on device recalculates the commands to actuators and switch them on, if necessary, otherwise does not carry out any action; you are recommended to set the behaviour of

actuator in order to switch the heating / cooling equipment off after bus power on.

Behaviour on ETS Download

After download it's possible to set initial value of:
 Heat / Cool mode
 HVAC Mode
 Ventilation

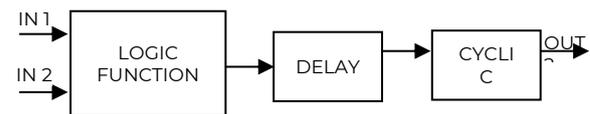
For other communications objects the behaviour is identical to bus voltage recovery.

18. Wrong application download

If the wrong ETS application is downloaded, then KNX/EIB led starts blinking and device is not operative on the bus. A power reset must be done or the correct ETS application must be downloaded.

19. Logics

The logic functions are organized into groups of 3 objects: 2 inputs and 1 output, except the one called "logic expression" that will be described later. The scheme of logics is as follows:



Inputs

Input datatypes can be bit, byte, float etc according to the selected logic.

IN1 is always present. IN2 maybe unused (or hidden directly by ETS).

Delay

The logic output can be delayed according to the ETS parameter, if a new value is received, the output is overwritten, and the delay reset.

Cyclic

The delayed output can be retransmitted n times according to ETS parameters

Logic function

Logic function type is defined by an ETS parameter, here the list of functions:

FUNCTION NAME	DESCRIPTION
Disabled	The logic block is disabled, no parameter / object is visible.
bit no transfer	Only delay and retransmission. IN1 is a bit.

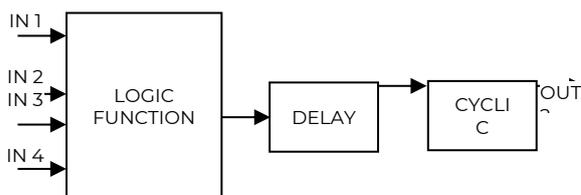
	IN2 is disabled. OUT is a bit.
byte no transfer	Only delay and retransmission. IN1 is a byte. IN2 is disabled. OUT is a byte.
bit NOT	OUT = NOT IN1 IN1 is a bit. IN2 is disabled. OUT is a bit.
bit AND	OUT = IN1 AND IN2 IN1 is a bit IN2 is a bit OUT is a bit.
bit OR	OUT = IN1 OR IN2 IN1 is a bit IN2 is a bit OUT is a bit.
bit NAND	OUT = NOT (IN1 AND IN2) IN1 is a bit IN2 is a bit OUT is a bit.
bit NOR	OUT = NOT (IN1 OR IN2) IN1 is a bit IN2 is a bit OUT is a bit.
bit XOR	OUT = IN1 XOR IN2 IN1 is a bit IN2 is a bit OUT is a bit.
bit XNOR	OUT = NOT (IN1 XOR IN2) IN1 is a bit IN2 is a bit OUT is a bit.
bit to byte conversion	2 ETS parameters: BYTE_0, BYTE_1. When 0 is received, BYTE_0 is sent. When 1 is received, BYTE_1 is sent. IN1 is a bit. IN2 is disabled. OUT is a byte.
byte to bit conversion	1 ETS parameter: BYTE_V. When a value equal to BYTE_V is received then a telegram 0,1, or nothing is sent. When a value different from BYTE_V is received then a telegram 0,1, or nothing is sent IN1 is a byte. IN2 is disabled. OUT is a bit.
byte threshold	1 ETS parameter: BYTE_V. When a value less or equal to BYTE_V is received then a telegram 0,1, or nothing is sent. When a value greater than BYTE_V is received then a telegram 0,1, or nothing is sent IN1 is a byte. IN2 is disabled. OUT is a bit.
2 byte float threshold	1 ETS parameter: 2BYTE_F. When a value less or equal to 2BYTE_F is received then a telegram 0,1, or nothing is sent. When a value greater than 2BYTE_F is received then a telegram 0,1, or nothing is sent IN1 is a 2 bytes float. IN2 is disabled. OUT is a bit.
4 byte float threshold	1 ETS parameter: 4BYTE_F. When a value less or equal to 4BYTE_F is received then a telegram 0,1, or nothing is sent.

	When a value greater than 4BYTE_F is received then a telegram 0,1, or nothing is sent IN1 is a 4 bytes float. IN2 is disabled. OUT is a bit.
proportional fancoil	This logic is to have a thermostat where you can set Temperature, Setpoint and Mode (Heat or Cool) and it calculates the output value % and send it on the bus with 1 Byte Object. Parameters are: Dead Band; Proportional band; control type (P or PI); system type (1 valve or 2 valves)
proportional / speed fancoil conversion	This logic is to convert a 1 byte value % (given by a thermostat) into a 3x1 bit object speed control value to manage fan coils. By setting the parameter "proportional conversion" it can be also a conversion from 3x1-bit object speed into a 1 byte object value %
dew point humidistat	This logic is to calculate the dew point given relative humidity , temperature,
surveillance	This logic allows to monitor an object via BUS via a status object and send an alarm telegram in case of non-reception.
expression	See next paragraph

Expression

Logic expression can be used to implement custom logic and arithmetic operation between values received on the KNX bus.

The logic expression has 5 objects: 4 inputs and 1 output. The scheme of logic expression is as follows:



Inputs (A, B, C, D) and output (OUT) objects

The datapoints can be configured through an ETS parameter:

- bit
- unsigned byte
- signed byte
- unsigned 2 bytes
- signed 2 bytes
- float 2 bytes (eg. temperature, humidity, ...)
- unsigned 4 bytes
- signed 4 bytes
- float 4 bytes (eg. power, energy, ...)

Expression

Configurable through an ETS parameter of 16 (maximum) character string. The output of the logic is the arithmetic evaluation of this expression.

Inputs objects can be accessed through their letters (A, B, C, D), the result is sent to the delay block.

Permitted operands:

"+"	arithmetic sum
"-"	arithmetic subtraction
"*"	arithmetic multiplication
"/"	arithmetic division
"&"	logic AND
" "	logic OR
"^"	logic XOR
"!"	logic NOT
">"	greater than
"<"	less than
"="	equal to
"?" ":"	ternary conditional
"(" and ")"	grouping operands

Ternary conditional:

<condition> ? *<expression1>* : *<expression2>*

Where:

condition is the expression to be evaluated.
expression1 is evaluated when *condition* is TRUE
expression2 is evaluated when *condition* is FALSE
expression1 or *expression2* can be "N" when "no expression has to be evaluated"

Expression examples:

"(A+B+C)/3" calculate the mean of the A, B, C objects

"A*9/5+32"	convert object A Celsius degree to Fahrenheit degrees
"A*1000"	convert object A KW to W
"A*3.6"	convert object A m/s to Km/h

- Quotation marks must not be included in expressions
- If wrong or unrecognized characters are used in expression, then it will be not processed and discarded.

20. Smart Thermostats

In the HA08A01KNX module, 8 logics can be used to activate 4 thermostats, in addition to the 4 thermostats configurable through the analog inputs 1,2,3 and 4. In total, 8 thermostat modules are available to manage the 8 independently triac outputs.

For these Smart Thermostat modules, the reference temperature can be provided via KNX bus.