ekinex

CONTROL YOUR LIVING SPACE

Application manual

KNX movement detector for wall flush mount EK-SM2-TP

Contents

1 Scope of the document

This manual describes application details for the A1.0 release of the ekinex movement detector series EK-SM2-TP.

This document is aimed at the system configurator as a description and reference guide for device features and application programming. For details about mechanical and electrical features, please refer to the technical datasheet of the device.

This manual and application programs for the device to be used in the ETS® development environment are available for download on the www.ekinex.com website.

Item	File name (## = release)	Version	Device rel.	Update
Technical datasheet	STEKSM2TP_EN.pdf	-	A1.0	05 / 2014
Application manual	MAEKSM2TP_EN.pdf	-		
Application program	APEKSM2TP##.vd4	-		

You can access the most up-to-date version of the full documentation for the device using following QR code:

2 Product description

The ekinex® movement detector is a KNX S-mode device for the indoor detection of occupancy and movement of people, with an effective detection range of 180° (horizontal) / 90° (vertical) thanks to its three passive infrared (PIR) sensors.

The detection range can be further extended by employing more ekinex® movement detector devices as slave units. Two channels C1 and C2 are available for the lighting function; these can be used to achieve a constant brightness control by using C2 as an offset input respective to C1 (from -50% to +50%).

The light intensity in constant brightness control is measured by the integrated brightness sensor; its value is made available for bus transmission in Lux units (2 byte). An orientation light function can be programmed with a standby value (in %) and a duration value (in minutes or hours).

The channel dedicated to HVAC applications allows the independent control of terminal devices dedicated to Heating, Ventilation and Air-Conditioning.

The device is equipped with an integrated bus communication module and is designed for wall flush mounting.

The device is powered by the KNX bus and no auxiliary power supply is required.

2.1 Versions and scope of supply

The main product code identifies a bare device that must be completed with following parts (to be ordered separately):

- lens with cover
- square front plate with 55 x 55 mm window
- square frame of Form or Flank series

The codes for relevant parts are listed in the table below:

Part	EAN Code	Variant	Product code
Movement sensor	8018417181740	-	EK-SM2-TP
Lens with cover	8018417183201	Ice white	EK-CLM-GAA
	8018417183218	Intense black	EK-CLM-GAE
	8018417183225	Silver	EK-CLM-GAG
Square plate with 55 x 55 mm window	–	*According to selected style*	*See general catalog*
Form or Flank frame	–	*According to selected style*	*See general catalog*

The metallic support frame, the fixing screws and the terminal block for the connection to the KNX bus are included in the supply.

The ETS application program can be downloaded from the ekinex® website www.ekinex.com.

2.2 Operation

The movement detector reacts to positional variation of the thermal radiation emitted by bodies. A person that crosses the monitored area automatically activates the lighting. As soon as the sensor does no longer detect any movement, a delay is started (whose duration is configured through ETS) after which the lighting is switched off.

If the standby mode is active, the lighting is maintained at a lower brightness level as an orientation light for the length of the configured standby time.

2.3 Light intensity measurement

The ambient light intensity is measured by an integrated brightness sensor having a linear output profile and an additional filter matched to the human visual sensitivity.

The light sensor is capable of sending a binary telegram (On or Off) to signal a light intensity level which is higher or lower than a configured threshold value, regardless to the operation mode. The measured brightness level in Lux units can further be transmitted on the KNX bus.

2.4 Lighting channel

Two operating modes can be chosen for the lighting channel during the configuration phase:

- fully automatic
- semi-automatic

The fully automatic mode has three different states, i.e. *ready*, *active* and *passive*, whereas the semi-automatic mode only has the *ready* and *active* states. In semi-automatic mode, the lighting is not activated after the detection of a movement, but only after pressing an external pushbutton.

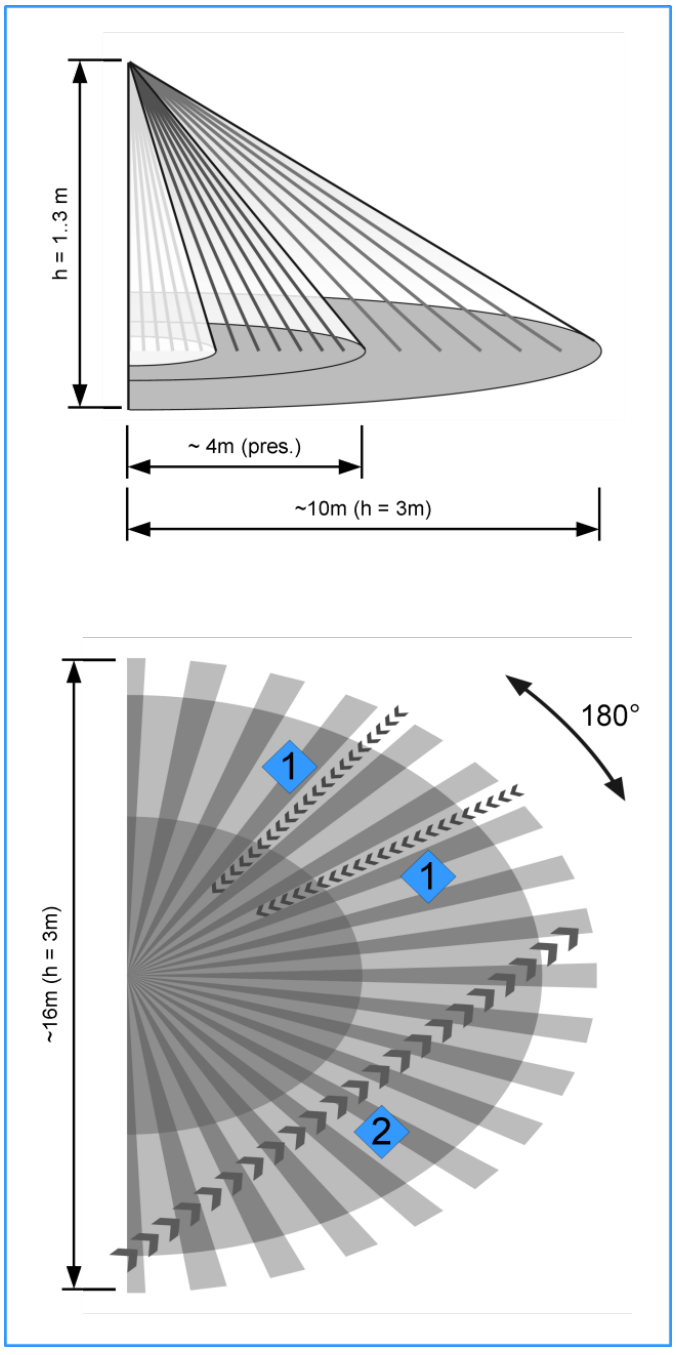
2.5 HVAC Channel

The HVAC channel has the same operating modes and communication objects as the lighting channel; the detection of movement and presence is enhanced though, introducing the “long duration” principle. The detection is based on several time windows (from 2 up to 20) of equal width; in every one of these windows at least one movement must be detected in order to yield a positive response.

2.6 Effective detection range

The effective sensor detection range varies according to the installation height. The more beaming sectors are crossed by the person to be detected, the higher is the effectivity at that range.

The sensor is capable of detecting presence (people sitting, small movements) within a range of 2 to 4 meter, and movement (people crossing the monitored field) within an area of 6 to 10 meters of radius.



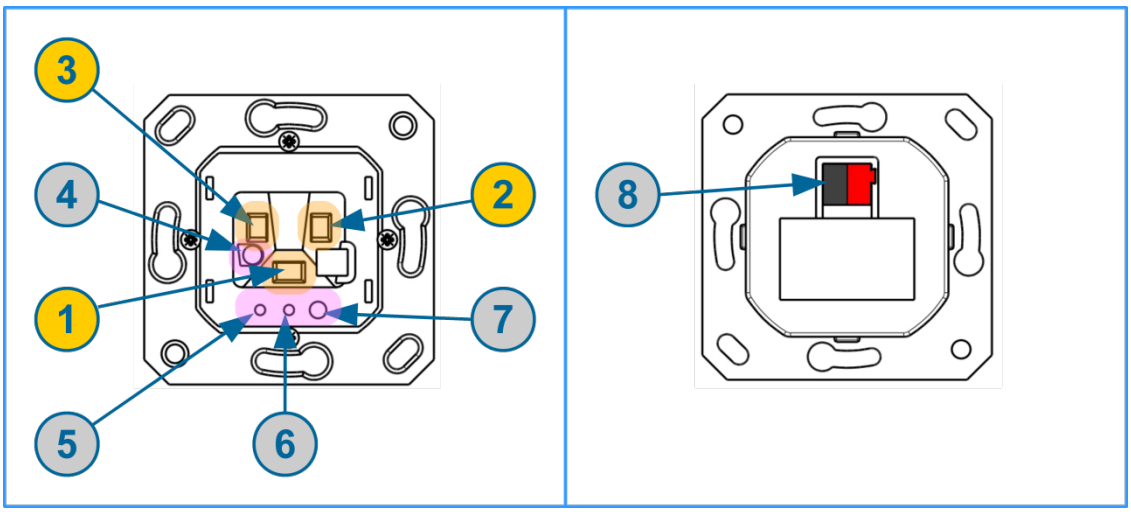
Mounting height [m]	People sitting, range [m] (radius)*	People moving, range [m] (radius)*
1,0	2	6
1,5	3	7
2,0	4	8
2,5	4	9
3,0	4	10

* Maximum values

1. **Maximum range**:
   Crossing several zones
2. **Limited range** (~ -50%):
   Frontal movement within a zone

For further details, please refer to the technical datasheet STEKSM2TP_IT.pdf available on the ekinex website www.ekinex.com.

2.7 Switching, display, sensing and connection elements



1) PIR Sensor (nr. 1)	5) Programming LED (red)
2) PIR Sensor (nr. 2)	6) Signal LED (Green)
3) PIR Sensor (nr. 3)	7) Programming button
4) Brightness Sensor	8) KNX bus connection plug

The device is equipped with a programming pushbutton and a programming LED, a signal LED, three PIR infrared sensors and a brightness sensor.

Switching elements:

- Pushbutton (7) to switch between the normal and programming operating modes

Signalling elements:

- Red LED (5) to indicate the active operating mode (on = programming, off = normal operation)
- Green LED (6) to signal movement/presence detection through blinking

Sensors:

- Brightness sensor (4) with linear output to measure the light intensity in the room (range: 5 ... 2000 Lux)
- Three passive infrared sensors (1, 2, 3) that can be activated individually or in groups.
  The numbers shown in the figure correspond to the ones used by the application program of the device.

Note: Programming pushbutton and LED are accessible from the front side of the device: it is therefore possible to set the device in programming mode after the sensor has been mounted on the wall. Once the unit address has been programmed, further configuration variations can be later downloaded without requiring the programming pushbutton to be pressed.

3 Configuration

The operation of the device is defined through the software-configured settings.

In order to configure the device, the ETS3 software tool (or later versions) is required, together with the ekinex® application program `APEKSM2TP##.vd4` (`##` stands for the version number). The application program can be downloaded from the ekinex website www.ekinex.com.

The application program allows the user to access, within the environment of the ETS configuration tool, the configuration of all of the device's working parameters. The application program file must be loaded in ETS (optionally the entire database of all ekinex products can be loaded in one single step); thereafter, any number of devices of the corresponding types can be added to the current ETS project.

The configurable parameters for the device are described in detail in the following sections.

The configuration can (and usually will) be defined entirely in an *off-line* fashion, i.e. without being connected to a device or a KNX network; the transfer of the configuration to the device(s) will therefore happen in a later phase (the programming phase, described in the following section).

Product code	EAN code	ETS application program (## = revision index)	Communication objects (Max nr.)	Group addresses (Max nr.)
EK-SM2-TP		APEKSM2TP##.vd4	19	254

Configuration and commissioning of KNX devices require specialized skills.

In order to properly acquire such skills, attendance to dedicated courses organized by KNX certified training centers is recommended.

4 Commissioning

After the device has been configured within the ETS project according to user requirements, the commissioning of the device requires the following activities:

- electrically connect the device, as described in the product datasheet, to the bus line on the final network or through a purposely setup network for programming;
- apply power to the bus;
- switch the device operation to programming mode by pressing the programming pushbutton located on the rear side of the housing. In this mode of operation, the programming LED is turned on steady;
- upload the configuration (including the physical address) to the device with the ETS program.

At the end of the upload, the operation of the device automatically returns to normal mode; in this mode the programming LED is turned off. Now the device is programmed and ready for use on the bus.

5 Device settings

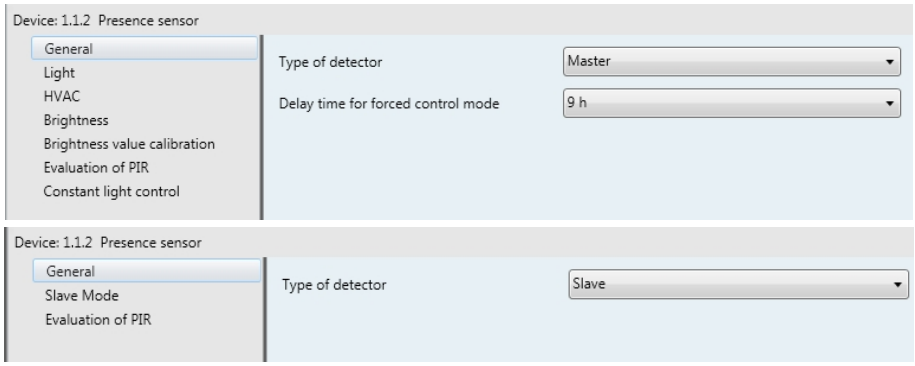
An unprogrammed device has no operating function. Since the functions of the device are entirely bound to the exchange of information with other devices on a same installation, the device cannot operate separately from the KNX bus.

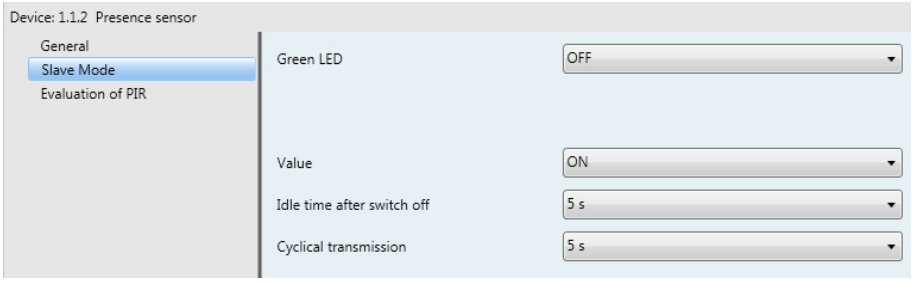
In order to access the device parameter configuration, an instance of the device must be added to an ETS project; the available parameters are listed under the “Parameters” tab in the lower part of the window.

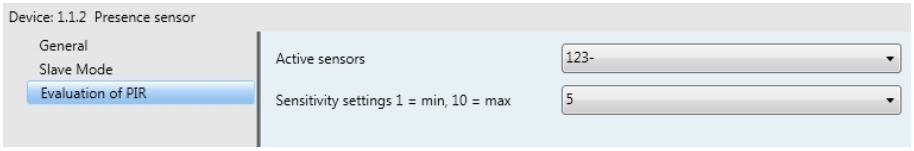
From here on, the following symbols will be used to better identify the input or output function of communications objects:

➔ input
➔ output

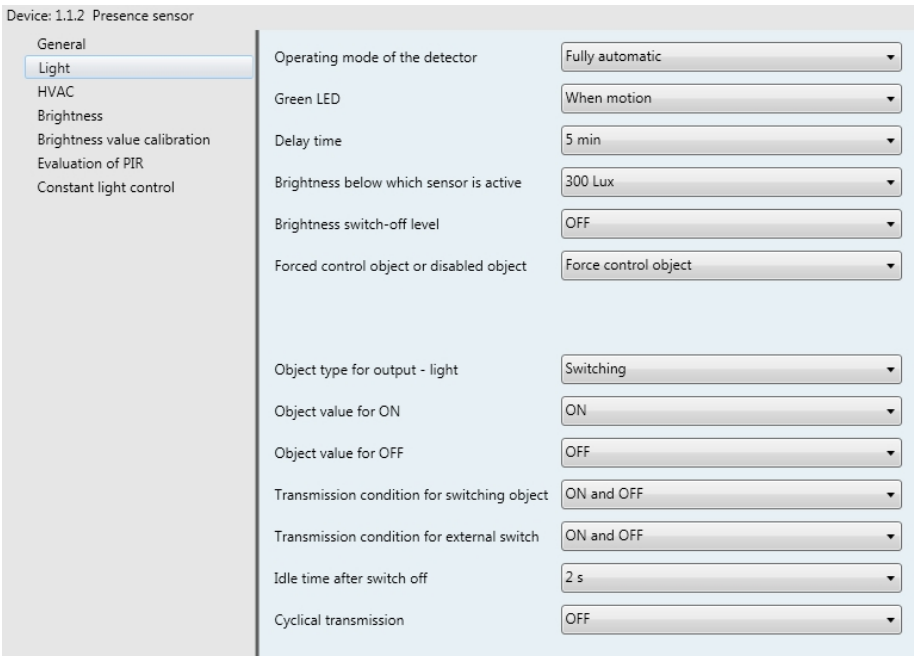
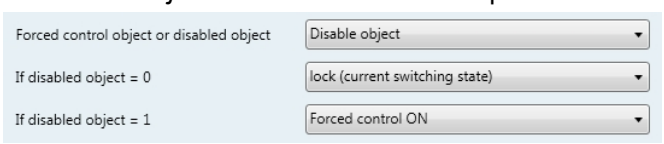
5.1 General

Parameters: **General**	
Type of detector	Sets the device role as ***Master*** or ***Slave***. The default value is **Master**.
Delay time for forced control mode	Defines the time interval after which the sensor automatically returns to AUTO mode, after an ON or OFF setting command has been sent. A time between 5 min and 9 h can be specified. *This parameter is only available if the device is in “slave” mode; other wise, its value is set to 30 s fixed.* The default value is **9 h**.

Parameters: **Slave mode** *(only available if "General / Type of detector" is "slave")*	
Green LED	For test purposes, the green LED can be activated whenever movement / presence are detected by the sensor. Available values are *When motion* and *OFF.* The default value is **OFF**.
Value	Available values are O*N* and *OFF.* The default value is **ON**.
Idle time after switch off	Allows to avoid undesired flickering of the switched load after a change of state. The dead time can be set in the range from 1 to 60 s. The default value is **5 s**.
Cyclical transmission	For systems having one master sensor and one or more slave sensors, it is recommendable to periodically reset the master unit; it is therefore recommended to leave the *Cyclical transmission* parameter always On. The range of allowed values is either OFF or between 1 s and 4 h in convenient steps. The default value is **5 s**.

Parameters: **Evaluation of PIR** *(only available if "General / Type of detector" is "slave")*	
Active sensors	The three available PIR (Passive Infra-Red) sensors on the device can be activated individualli or in partial groups. Numbers 1 to 3 match the sensor positions shown in the figure "PIR sensor numbering" in section 5.7. The default value is **123** (corresponding to all sensors active).
Sensitivity setting	Sensitivity can be adjusted on a scale from 1 to 10. The default value is **5**.

5.2 Illuminazione - Commutazione

Parameters: **Light - Switching**	
Operating mode of the detector	Sets the detector's operating mode as *Fully automatic* or *Semi-automatic*. The default value is **Fully automatic**.
Green LED	When presence / movement detection occurs, the LED can be set to flash (value: *When motion*) or remain off (value: *OFF*). The default value is **When motion**.
Delay time	The switch-off delay of the lighting channel (duration of lighting) can be set to a value ranging from *1 s* to *4 h*. The default value is **5 min**.
Brightness below which the sensor is active	Allows to set the value of the light – dark threshold that activates detector's operation (with decreasing ambient light). Values range from *10 Lux* to *2000 Lux* or *ALWAYS.* The default value is **300 Lux**. **Important:** if the lighting channel is meant to always remain active (even with ambient brightness above 2000 Lux) choose the "*ALWAYS"* setting.
Brightness switch-off level	Allows to set the maximum brightness value above which detector operation stops (with increasing ambient light); this is effective even if the switch-off delay is not expired yet. Values range from *10 Lux* to *2000 Lux* or *OFF.* The default value is **OFF**.
Forced control object or disabled object	Sets the type of communication object 3. *See also: Object 3 (Input - Light – Forced control / Disable) in section 6.1.6.* The selection *Disable object* enables two additional parameters as follows:  The default value is **Forced control object**.

*If disabled object = 0 **	Action to perform when a "0" is received. Available values are *Forced control ON, Forced control OFF, Automatic, Lock (current switching state), no action*. The default value is **Lock (current switching state)**.	
*If disabled object = 1 **	Action to perform when a "1" is received. Available values are *Forced control ON, Forced control OFF, Automatic, Lock (current switching state), no action*. The default value is **Forced control ON**.	
(*) requires selection *Disable object* for parameter *Forced control object or disabled object*		
Object type for output - light	Sets the type of communication object 0. Available values are *Switching*, *Absolute dimming*, *Scene*. The default value is **Switching**.	
Object value for ON	*If object type = Switching*	Available values are *ON* or *OFF* The default value is **ON.**
	If object type = Absolute dimming	Dimming value from *0%* to *100%* The default value is **100%.**
	If object type = Scene	Scene selection from *Scene 1* to *Scene 32* The default value is **Scene 2.**
Object value for OFF	*If object type = Switching*	Available values are *ON* or *OFF* The default value is **OFF.**
	If object type = Absolute dimming	Dimming value from *0%* to *100%* The default value is **0%.**
	If object type = Scene	Scene selection from *Scene 1* to *Scene 32* The default value is **Scene 3.**
Transmission condition for switching object	Condition to trigger transmission of communication object 0 *Output – Light – Switch.* Available values are *ON and OFF*; *Né ON né OFF*; *Solamente ON*; *Solamente OFF*. The default value is **ON and OFF**.	
Transmission condition for external switch	Condition to trigger transmission of communication object 1 *External switch – Light – Switch.* Available values are *ON and OFF*; *Né ON né OFF*; *Solamente ON*; *Solamente OFF*. The default value is **ON and OFF**	
Idle time after switch off	Allows to avoid undesired flickering of the switched load after a change of state. The dead time can be set in the range from 1 to 60 s. The default value is **5 s**.	
Cyclical transmission	Sets repeated transmission and assigned interval for the command (communication object 0). The range of allowed values is either OFF or between 1 s and 4 h in convenient steps. The default value is **OFF**.	

5.3 Light – Absolute dimming: Standby lighting

Standby light (orientation light)

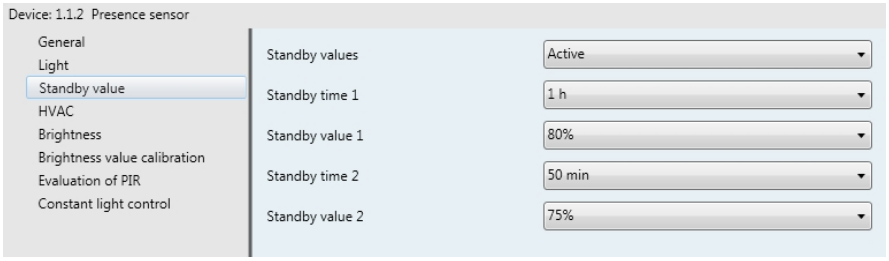
If the lighting channel function is set to *Absolute dimming*, the additional option *Standby values* is shown which can be used to set the *orientation light* feature.

Two pairs of values can be defined for the duration period and the lamp brightness of the standby light.

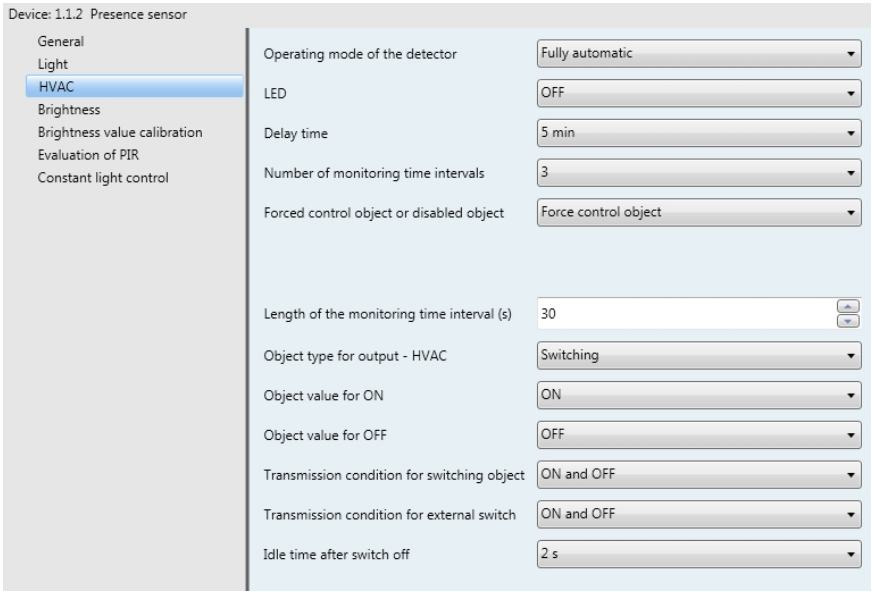
Once the switch-off delay time period is expired, object 24 ➔ controls which of the two valuepairs must be regarded as active:

- if the object value is 0 (or the object has not been received yet), pair nr. 1 is active;
- if the object value is 1, pair nr. 2 is active.

At the end of the standby light activity period, the “OFF” value is sent for the object. If presence / movement is newly detected during the standby time, the sensor becomes active again and the standby state is left. Lock and forcing both terminate the standby state.

Parameters: ***Standby value******	
(*) requires selection *Absolute dimming* for parameter *Object type for output – light*	
Standby values	Allows to enable the orientation light feature. Available values are *Active* or *Inactive.* The default value is **Inactive**.
Standby time 1 **	Sets the duration time in the **first** pair of values for the orienting light. Available values are OFF or a duration between *1 min* and *8 h* in convenient steps. The default value is **1 h**.
Standby value 1 **	Sets the dimming brightness in the **first** pair of values for the orienting light. Available values are between *0%* and *100%*. The default value is **80%**.
Standby time 2 **	Sets the duration time in the **second** pair of values for the orienting light. Available values are OFF or a duration between *1 min* and *8 h* in convenient steps. The default value is **50 min**.
Standby value 2 **	Sets the dimming brightness in the **second** pair of values for the orienting light. Available values are between *0%* and *100%*. The default value is **75%**.
(*) requires selection *Active* for the *Standby values* parameter	

5.4 HVAC

Parameters: **HVAC**	
All HVAC channel parameters are exactly the same as for the light channel, except for the following ones:	
Number of monitoring time intervals	Selects the number of monitoring time frames. Available values are between *1* and *32*. The default value is **3**.
Length of the monitoring time interval (s)	Sets the duration of all monitoring time frames. Available values are between *1 s* and *30.000 s* (corresponding to 8 hours, 20 minutes). The default value is **30 s**.

Warning

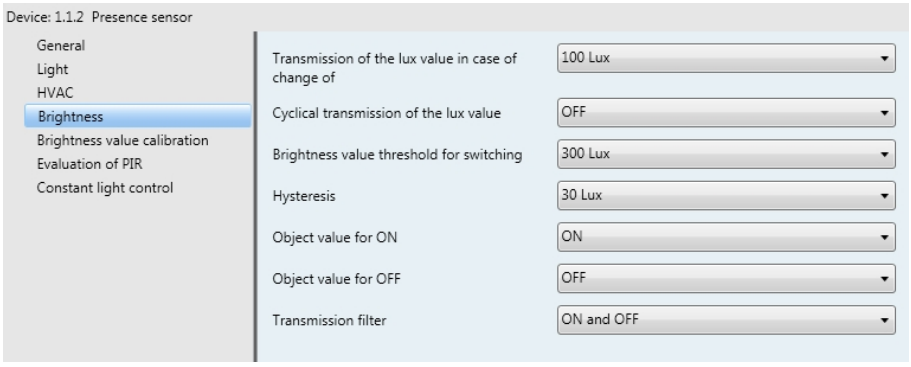
For the quickest reaction of the HVAC channel, following values are suggested:

Number of monitoring time intervals: 1
Length of the monitoring time interval: 1

Occupancy detection function

The above suggested parameter setting should be chosen for the occupancy detection function (the occupancy signalization is independent from the ambient lighting brightness).

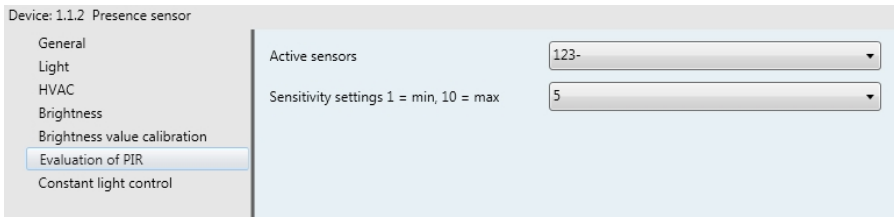
5.5 Brightness

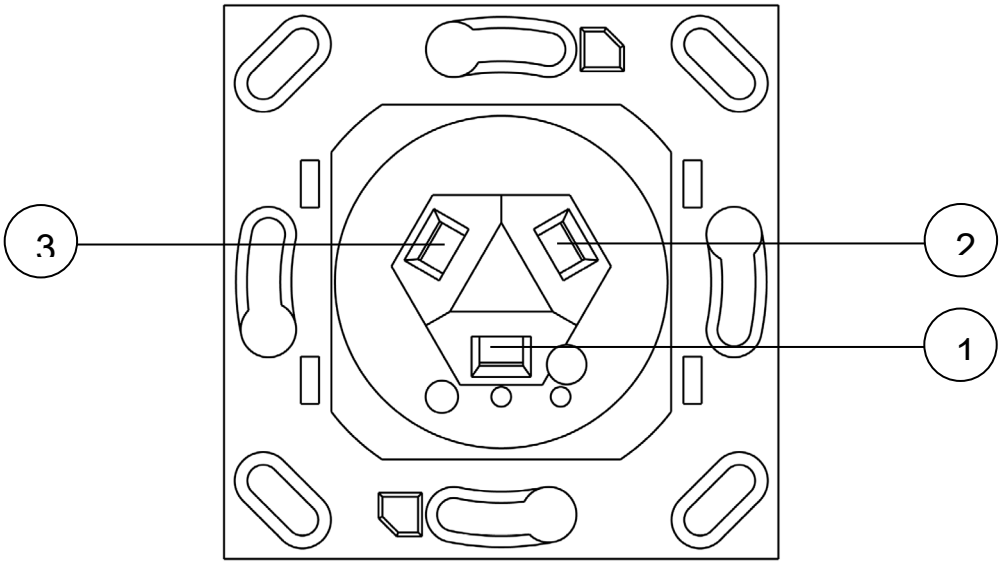
Parameters: **Brightness**	
This menu allows to set the parameters for the output communication objects 8 (Brightness threshold switch value – Switch, 1 bit) and 9 (Brightness value – Lux, 2 bytes).	
Transmission of the lux value in case of change of	This parameter enables the transmission of the brightness value, i.e. communication object 9, every time the selected threshold (see parameter *Brightness value threshold for switching*) is exceeded by the specified value. Available values range from *10 Lux* to *1800 Lux* or *OFF*. *Please notice that this value is the variation respective to the threshold value.* The default value is **100 Lux**.
Cyclical transmission of the lux value	Available values range from *5 s* to *30 min* or *OFF*. The default value is **OFF**.
Brightness value threshold for switching	Available values range from *10 Lux* to *2000 Lux* or *OFF*. The default value is **300 Lux**.
Hysteresis	Available values range from *5 Lux* to *200 Lux* or *OFF*. The default value is **30 Lux**.
Object value for ON	Selects which value of the switch communication object 8 corresponds to the active state of the threshold comparation. Available values are *ON* or *OFF*. The default value is **ON**.
Object value for OFF	Selects which value of the switch communication object 8 corresponds to the inactive state of the threshold comparation. Available values are *ON* or *OFF*. The default value is **OFF**.
Transmission filter	Selects which state changes for the threshold activation trigger the transmission of the switch communication object 8. Available values are: *ON* and *OFF*; *neither ON nor OFF*; *only ON*; *only OFF*. The default value is **ON e OFF**.

5.6 Brightness value calibration

Parameters: **Brightness value calibration**	
Calibration	If this parameter is set to *No* (default value), factory calibration for the sensor is in effect. By selecting *Yes*, two additional parameters are shown (*AD Calibration value* and *Lux value*) which allow to customize the sensor calibration. The custom values override the factory calibration: this can be restored at any time by returning to selection “No” for this parameter and performing device programming through ETS.
*AD calibration value**	In order to correctly set this parameter, the AD calibration value (communication object 10) should be read through ETS, and the value should be input in this field. **Warning.** In the ETS Group Monitor, when reading or sending this value, the Data Point Type **7.001 pulses (2-byte counter, unsigned)** should be used. The value read from the AD will appear in the “*Received value:*” field as e.g. “*739 pulses*”.
*Lux value**	A reference brightness value should be measured with an external Luxmeter; the measured value should be input in this field.
(*) requires selection *Yes* for parameter *Calibration*	
For further details please refer to the description of the *AD calibration value* communication object 10.	

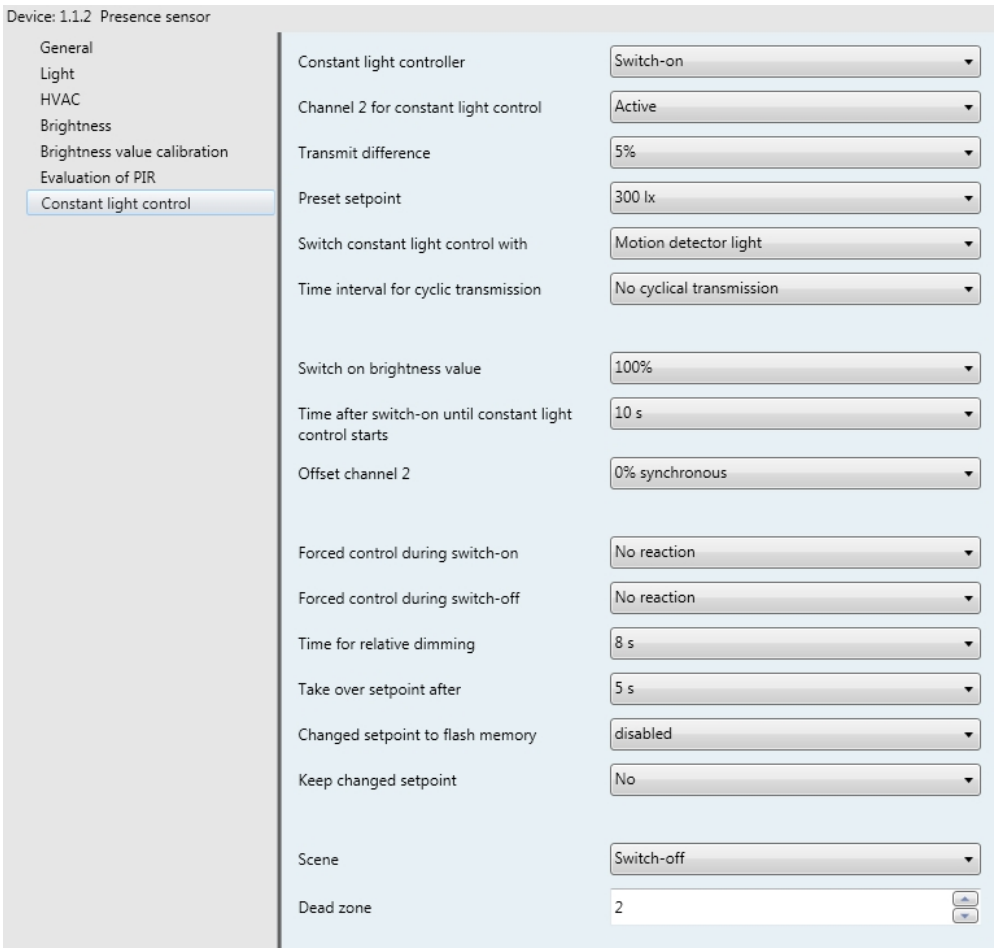
5.7 Parametrization of PIR sensors

Evaluation of PIR	
Active sensors	I 3 sensori PIR sono attivabili singolarmente o a gruppi. I numeri 1, 2 e 3 corrispondono alle posizioni 1, 2, 3 rappresentate sotto in figura. The default value is **123** (tutti i sensori attivi).
Sensitivity settings *1 = min, 10 = max*	La sensibilità può essere impostata da 1 a 10. The default value is **5**.



PIR sensor numbering

5.8 Constant light control

Parameters: **Constant light control**	
Constant light controller	Through this parameter the constant brightness control can be enabled. The default value is **OFF**.
All following settings are only displayed on the page if parameter "*Constant light controller*" is set to *ON.*	
Channel 2 for constant light control	Enables channel 2 for constant light control. Available values are *Active* and *Inactive*. Communication object 23 is made available to send a selectable value with a fixed offset; the "*Offset Channel 2*" parameter is only displayed if the selected value for this parameter is "*Active*". *Please see the notes at the bottom of this section for further details about the operation of Channel 2.* The default value is **Inactive**.
Transmit difference	Defines the tolerance window that must be trespassed in order to trigger the transmission of a new brightness value. Available values range from *1%* to *20%*. The default value is **5%**.
Preset setpoint	This is the target value to be possibly achieved by light control. The value can be accessed and modified through dimming communication objects 17 and 18. Available values range from *10 Lux* to *2000 Lux.* The default value is **300 lux**.

Switch constant light control with	Activation of constant light control – that is, light switching – can be caused by 3 different sources, i.e. communication object 16 (*Object*), light movement sensor (*Motion detector light*), or HVAC movement sensor (*Motion detector HVAC*). The one that will actually be used is selected through this parameter. The default value is **Motion detector light** .
Time interval for cyclic transmission	Enables a repeated transmission of the current brightness value with a timeout period, even if the threshold window is not exceeded. Available values range from *5 s* to *10 min* or *No cyclical transmission*. The default value is **No cyclical transmission** .
Switch on brightness value	Allows to preset the dimming brightness value at switch-on. Available values range from *1%* to *100%*. The default value is **100%**.
Time after switch-on until constant light control starts	Allows to set a delay after switch-on before the constant brightness control becomes active. Available values range from *1 s* to *5 min*. The default value is **10 s**.
*Offset channel 2 ****	The offset range for channel 2. Available values range from -50% to +50%. The default value is **0% - synchronous**.
(*) requires selection *Active* for parameter *Channel 2 for constant light control*	
Forced control during switch-on	Allows to define how the constant light control should react when a “1” value is received on the *Forced control* object. Available values are: *No reaction; Minimum brightness; Maximum brightness.* The default value is **No reaction**.
Forced control during switch-off	Allows to define how the constant light control should react when a “0” value is received on the *Forced control* object. Available values are: *No reaction; Minimum brightness; Maximum brightness; Last value.* The default value is **No reaction**.
Time for relative dimming	Sets the duration step for relative dimming. Available values range from *2 s* to *15 s*. The default value is **8 s**.
Take over setpoint after	Defines the timeout period after which a setpoint becomes effective (provided no new setpoint value is received in the meantime). Available values range from *1 s* to *5 min*. The default value is **5 s**.
Changed setpoint to flash memory	Defines whether a new setpoint value shall overwrite the value set through ETS configuration as new default. Available values are *Enabled* or *Disabled*. The default value is **Disabled**.
Keep changed setpoint	If set to *Yes*, the latest received value is stored in RAM memory. In this case, *the last brightness value received becomes the new setpoint.* Available values are *Yes* or *No*. The default value is **No**.

Scene	Enables a set of configurable brightness setpoint values that can be associated to scene numbers; the scenes can be recalled through communication object 21 "*Constant light control – Scene".* Available values are *Switch-on* and *Switch-off*. The default value is **Switch-off**. (i.e. Disabled)
Dead zone	The *dead zone* is the value range in which the current brightness value is allowed to stray without triggering a change in the control action. In this case, the actual value is used for comparison with the latest output value issued by the controller. The value of the dead band expressed in Lux is a non-trivial function of current brightness value (last actual control value): since the human sensitivity to brightness is basically logarithmic, this dependency is also strongly non-linear. In order to simplify the matter, an equivalent index value is introduced for the parameter setting; this index value, which must be used for configuration, is bound to the desired value in Lux as shown in the table listed at the end of this section. The default value for this parameter is **2**.

Parameters: **Constant light control - Scene**	
*Scene n (1..8)**	Allows to preset the constant brightness setpoint value for each available scene. Available values range from *10 Lux* to *2000 Lux* or *OFF*. The default value is **500 Lux**.
(*) requires selection *Switch-on* for parameter *Constant light control-Scene*	

Dependency of the dead-zone value from current brightness value

The value for the dead band, expressed in Lux, can be looked up from following table.

Brightness [Lux]	Index value 1	2	3	4	5	6	7	8	9	10
100	2	5	7	10	12	15	17	20	23	26
200	5	9	14	19	24	30	35	40	46	52
300	7	14	21	29	37	44	52	61	69	78
400	9	19	29	39	49	59	70	81	92	104
500	12	24	36	48	61	74	87	101	115	129
600	14	28	43	58	73	89	105	121	138	155
700	16	33	50	68	85	104	122	142	161	181
800	19	38	57	77	98	119	140	162	184	207
900	21	42	64	87	110	133	157	182	207	233
1000	23	47	72	96	122	148	175	202	230	259
1100	26	52	79	106	134	163	192	222	253	285
1200	28	57	86	116	146	178	210	243	276	311
1300	30	61	93	125	159	193	227	263	299	337
1400	33	66	100	135	171	207	245	283	322	362
1500	35	71	107	145	183	222	262	303	345	388
1600	37	75	114	154	195	237	280	324	368	414
1700	40	80	122	164	207	252	297	344	391	440
1800	42	85	129	174	220	267	315	364	414	466
1900	44	90	136	183	232	281	332	384	438	492
2000	47	94	143	193	244	296	350	405	461	518

Table values yield the dead zone tolerance +/- [Lux]

Example:

- Dead zone parameter index value = **2**
- Current brightness = **500 Lux**
  the resulting tolerance read from the table is **+/- 24 Lux**

In this example, the actual brightness value can vary from 476 to 524 Lux without involving a control action.

Operation of Channel 2 for constant light control

With constant light control, in addition to channel 1 (communication object 22 ←) a second object is available for channel 2 (communication object 23 ←).

Channel 2 sends a configurable value with a fixed offset. Internally, the control range is widened exactly by the amount of the offset value, in order to achieve a stable control range in proximity of the field boundaries.

This means that, for instance, with an offset value of -50% and in full darkness conditions, both objects yield the hexadecimal value FF (corresponding to 100%).

Example:

Let the internal values of objects 1 and 2 be respectively 150% (value 1) and 100% (value 2); this means that the offset of object 2 is -50%.

If the natural ambient brightness increases by a value *x*, the control mechanism acts to decrease artificial lighting: value 1 decreases towards 100% (i.e. 150% - *x*), and value 2 is consequently reduced (150% - 50% - x).

If value 1 falls under 100% (say, down to 73%), value 2 falls to 23% (i.e. 73% - 50%). As soon as value 1 becomes lower than 50%, value 2 (which would become negative) is clamped to its minimum allowable value, that is, 0%.

6 Functional blocks

The functions of the presence detector can be divided into following blocks:

- *Input:* presence / movement sensing
- *Input*: ambient brightness measurement
- *Output*: Lighting control channel - switching
- *Output*: Lighting control channel – absolute dimming with standby feature
- *Output*: HVAC control channel (with presence feature)
- *Output*: Brightness threshold switch, twilight switch
- *Output*: 2 channels for constant brightness control

The presence sensor and the brightness measurement have independent effects on the Lighting and HVAC channels.

The constant brightness control block gets its input from the actual value measured by the ambient brightness measurement block.

The activation (start of constant brightness control) and deactivation can be bound to either of communication object 16, Lighting channel or HVAC channel. After device power on and after a bus recovery, an activation is usually effected.

6.1 Lighting control channel

The lighting control channel has two different operating modes that can be selected through the corresponding parameter. These modes are:

- *fully automatic*
- *semi-automatic*

The difference between these two modes can be summarized as follows:

- fully automatic mode has three operating states, i.e. *Ready, Active* and *Inactive*, whereas semi-automatic mode only has *Ready* and *Active* states;
- in fully automatic mode, lighting is switched on whenever movement or presence is detected; in semi-automatic mode, this can only happen through an external switch (pushbutton).

When the channel is activated, the channel object is set to an “ON” value (depending on the configuration) and transmitted; at the same time, the off-delay time count is started (this time is specified through the parameter *Delay time*). At the end of the delay time, when the channel deactivates, the object is set to an “OFF” value (again depending on the configuration) and transmitted.

Following is a description of relevant objects involved in the operation of this channel.

6.1.1 Object 0 Output – Light – Switch

← Output - 1 Bit

If the object type for output is set to “Switching”, the values sent for activation and deactivation can only be of the binary type “ON” and “OFF”; any of the two possible values can be attributed to each one of the two events.

6.1.2 Object 0 Output – Light – Absolute dimming

← Output - 1 Byte

If the object type for output is set to “Absolute dimming”, two distinct dimming percentage values (0% to 100%) can be associated to the two events.

6.1.3 Object 0 Output – Light – Scene

← Output - 1 Byte

If the object type for output is set to “Scene”, two distinct scene numbers (from 1 to 32) can be associated to the two events.

6.1.4 Object 1 External switch / status – light – Switch

➔ Input - 1 bit

The input object 1 *External switch / status* can be used in two different ways:

- as input for an external pushbutton that directly controls lighting activation;
- as input that receives the state or command from an actuator.

In both cases, a telegram with the “ON” value activates the lighting channel, whereas an “OFF” value puts the device in the “*ready”* state.

The parameter “*Transmission condition for external switch”* determines which transition of the input trigger the transmission of the value of the switching object on the bus.

Upon receiving an “ON” command, the delay time is started, just as as if a movement had been detected; at the end of the delay time (unless an “OFF” command is received in the meantime), the lighting is deactivated.

Upon receiving an “OFF” command, the lighting is deactivated; the sensor goes into a deactivation state, during which movement detection is suspended. The duration of this deactivation state can be set through the “*Idle time after switch off*” parameter. When the deactivation time expires, the detector becomes ready for operation again.

6.1.5 Object 2 External motion – light – Switch

➔ Input - 1 Bit

This object serves the purpose of connecting other detectors as slave units.

Any movement detected from the slave unit is handled exactly as if it had been detected by the master unit; the devices are effectively connected in parallel. In the Master-Slave connection, all output communication objects (object 0) of the slave devices must be connected with the input communication object (object 2) of the master, i.e. a common group address must be attributed to all these communication objects.

6.1.6 Object 3 Input - Light – Forced control / Disable

This object can have two purposes, namely “Forced control” or “Disable”, according to the setting of parameter “*Forced control object or disable object”.*

Forced control object

➔ Input - 2 Bit

In this setting, the object can receive three different values (2-bit command) corresponding to three conditions:

(1) *Forced control ON* (Control bit = 1, Value bit =1). In this condition, upon movement detection an ON command is sent to the output object. Movement detection is suspended and the off-delay time count is started. If the Forced control object does not receive any further telegram, at the end of the delay time the normal operation resumes.
(2) *Forced control OFF* (Control bit = 1, Value bit =0). In this condition the operation is exactly like in the previous case, except that an OFF value is assigned to the output object.

(3) *Forced control AUTO* (Control bit = 1, Value bit =0). Normal detector operation is resumed.

Disable object

➔ Input - 1 Bit

In this setting, the object can receive two values (1-bit command).

The reaction of the device at the reception of both of these values can be selected through parameters "*If disabled object = 0"* and "*If disabled object = 1"* (under the menu "Light").

Both events can be associated to any one of following actions:

- *Forced control ON*
- *Forced control OFF*
- *Automatic*
- *Lock (current switching state)*
- *No action*

Warning: in case of wrong parameter setting (e.g. "Lock" associated to value 0, "No action" associated to value 1, and *General / Delay time for forced control mode* set to OFF), the device can enter a lockdown state which can only be recovered by reprogramming.

6.2 HVAC control channel

The HVAC control channel has the same communication objects as the Lighting channel and works exactly in the same way;

The HVAC channel has the same operating modes and communication objects as the lighting channel; the normal detection of movement and presence is replaced by a "long duration" detection.

Long duration detection is based on several time windows (from 2 up to 20) of equal width; in every one of these windows at least one movement must be detected in order to yield a positive response. The number and (common) duration of these time windows can be configured through the respective parameters. The total time required for a positive detection is the product of the selected number of windows by their duration.

Presence function

The HVAC channel can be used to detect the occupancy of the monitored area. To this purpose, the number of windows should be set to 1 and the duration should be set to 1 s.

Operation of the HVAC channel is independent from ambient brightness.

6.2.1 Object 4 Output – HVAC (switching) – Switch

➔ Output - 1 Bit

Object 4 *Output – HVAC (switching) – Switch* is similar to Object 0 *Output – Light – Scene*, but it has several additional features (see also *HVAC Parameters* in section 6.1).

6.2.2 Object 5 External switch / status – HVAC - Switch

➔ Input - 1 Bit

Object 5 *External switch / status – HVAC - Switch* behaves the same as Object 1 *External switch / status – light – Switch*.

6.2.3 Object 6 External motion – HVAC (switching) - Switch

➔ Input - 1 Bit

Object 6 *External motion – HVAC (switching) - Switch* behaves the same as Object 2 *External motion – light – Switch*.

6.2.4 Object 7 Input – HVAC – Forced control

➔ Input - 2 Bit

Object 7 *Input – HVAC – Forced control* behaves the same as Object 3 *Input - Light – Forced*.

6.2.5 Object 7 Input – HVAC – Disable

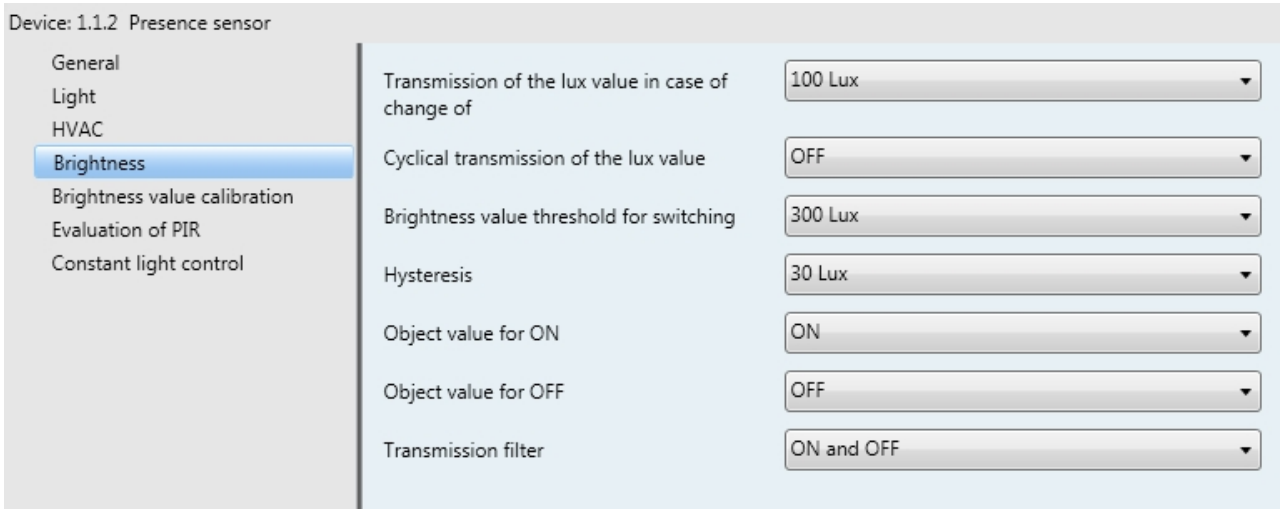
➔ Input - 1 Bit

Object 7 *Input – HVAC – Disable* behaves the same as Object 3 *Input - Light –Disable*.

6.3 Brightness threshold switch

This functional block has two output communication objects:

- *Brightness threshold switch*
- *Brightness value*



6.3.1 Object 8 Brightness threshold switch value - Switch

➔ Output - 2 Bytes

Object 8 (*Brightness threshold switch value - Switch*) is sent with a selectable value (ON or OFF) when measured brightness is higher than the value selected for the threshold value.

When brightness drops under the threshold value, minus the value selected for the Hystheresis parameter, a second selectable value (ON or OFF) is then sent.

Transmission can be selected for only one of these two events, both, or none, through parameter "*Transmission filter*".

6.3.2 Object 9 Brightness value - Lux

➔ Output - 2 Bytes

Object 9 (*Brightness value - Lux*) sends the current measured value of brightness in Lux. Transmission is triggered when variations of the measured value are higher than the configured value for parameter "*Transmission of the lux value in case of change of"*; apart from this trigger, transmission can also be made at regular intervals specified by parameter "*Cyclical transmission of the lux value"* (which can be deactivated by an OFF value).

6.4 AD Calibration

6.4.1 Object 10 AD Calibration value

← Output - 2 Bytes

Object 10 is never transmitted; it is only available for reading by other devices. The current value of the AD converter that handles the brightness signal is made available as unsigned 16-bit value.

The measurement can be calibrated as described below:

1. Measure ambient light with an external instrument (luxmeter) in a well-controlled condition (e.g. against an evenly illuminated light-colored table top). This value will serve as reference;
2. Read the current AD calibration value (Communication object 10) through ETS.
   Warning: in the *Group monitoring* menu in ETS, choose *7.001 pulses* (under *7.* 2-byte unsigned value*) for the exchanged data in the Data point type selection box. The value read from the AD converter will be displayed in the *Received value* field as number of pulses.
3. Use the above two values to fill the parameters *Lux value* and *AD calibration value* respectively in the *Brightness value calibration* menu section.

6.5 Objects for constant brightness control

6.5.1 Object 16 Constant light control – Switch ON/OFF

➔ Input - 1 Bit

This object is the input command that enables constant light control; in order for the object to be made available, parameter *Switch constant light control with* must be set to selection *Object*. Alternatively, through the same parameter, the presence detector output (both in light and HVAC modes) can be selected as the enabling source.

6.5.2 Object 17 Constant light control – Dim relative

➔ Input - 4 Bit

This object sets the current setpoint for dimming in relative mode (increment or decrement), with a 1% step resolution.

The new setpoint can be transmitted e.g. by a KNX pushbutton unit; the resulting actual brightness value can be read from Communication object 9 *Brightness value* e.g. for display on a KNX-connected panel.

Important: parameter *Take over setpoint after* allows to configure a time delay before a newly transmitted setpoint becomes effective. After this delay, the new setpoit is written into RAM memory (although not in retentive Flash memory).

Warning: a newly transmitted setpoint, while waiting for the delay to expire, only remains stored as long as presence is detected. If the presence state changes, the default setpoint configured through ETS returns in effect. If the newly transmitted value is meant to become the new default setpoint, then the value *Yes* must be selected for parameter *Changed setpoint to flash memory*.

6.5.3 Object 18 Constant light control – Dim completely

➔ Input - 1 Byte

This object directly sets the absolute value (in %) for the dimming setpoint. All considerations made in section above also apply to this object.

6.5.4 Object 20 Constant light control – Forced control

➔ Input - 1 Bit

Upor reception of an ON or OFF value for this object, different actions can be triggered; these actions can be selected through parameters *Forced control during switch-on* and *Forced control during switch-off*.

Available values for both selections are *No reaction; Minimum brightness; Maximum brightness; Last value* (the latter one associated to the OFF value only)

6.5.5 Object 21 Constant light control – Scene

➔ Input - 1 Byte

Eight brightness settings, each ranging from *10 lux* to *2000 lux* (or alternatively an OFF state) can be associated to corresponding scene codes.

A scene code received by this object causes the corresponding brightness value to be taken as new setpoint.

6.5.6 Object 22 Constant light control channel 1 – Output

← Output - 1 Byte

This communication object is used to control the dimmer actuator for channel 1 through an absolute dimming command.

6.5.7 Object 23 Constant light control channel 2 – Output

← Output - 1 Byte

This communication object is used to control the dimmer actuator for channel 2 through an absolute dimming command; the dimming value is the same value sent for channel 1 corrected by the application of the offset defined through parameter *Offset channel 2*.

6.5.8 Object 24 Light - standby

→ Input - 1 Bit

This object defines which of the two available value pairs for the standby condition are in effect (see also section 5.3, *Standby values*).

7 Appendix

7.1 KNX Communication Objects summary

Following table lists all KNX communication objects defined by the application program for any configuration.

Object	Dir	Function	Typical connection with:	Size
0	←	Output – Light – Absolute dimming	Lighting actuator	1 Byte
0	←	Output – Light – Switch	Lighting actuator	1 Bit
0	←	Output – Light – Scene	Lighting actuator	1 Byte
1	→	External switch / status – light – Switch	KNX pushbutton, display, other	1 Bit
2	→	External motion – light – Switch	Lighting output (Object 0) of slave	1 Bit
3	→	Input - Light – Forced control	External controller or module	2 Bit
3	→	Input - Light – Disable	e.g. KNX pushbutton, display panel, other controller	1 Bit
4	←	Output – HVAC (switching) – Switch	Actuator, HVAC terminal, Alarm supervisor, Presence recorder	1 Bit
5	→	External switch / status – HVAC - Switch	e.g. KNX pushbutton, touch panel controller, other controller	1 Bit
6	→	External motion – HVAC (switching) - Switch	HVAC output (Object 4) of slave	2 Byte
7	→	Input – HVAC – Forced control	External controller or module	2 Bit
7	→	Input – HVAC – Disable	e.g. KNX pushbutton, touch panel controller, other controller	1 Bit
8	←	Brightness threshold switch value - Switch	External controller or module, actuator	1 Bit
9	←	Brightness value - Lux	e.g. panel display, other controller	2 Byte
10	←	AD Calibration value	Readout for manual setting during AD calibration procedure	2 Byte
16	→	Constant light control – Switch ON/OFF	e.g. KNX pushbutton, other controller	1 Bit
17	→	Constant light control – Dim relative	e.g. KNX pushbutton, touch panel controller, other controller	4 Bit
18	→	Constant light control – Absolute dimming	External controller or module	1 Byte
20	→	Constant light control – Forced control	e.g. KNX pushbutton, other controller	1 Bit
21	→	Constant light control – Scene	External controller or module	1 Byte
22	←	Constant light control channel 1 – Output	Dimming actuator	1 Byte
23	←	Constant light control channel 2 – Output	Dimming actuator	1 Byte
24	→	Light - standby	e.g. touch panel controller, other controller	1 Bit

← = Output object

→ = Input object

7.2 Warnings

- Installation, electrical connection, configuration and commissioning of the device can only be carried out by qualified personnel in compliance with the applicable technical standards and laws of the respective countries.
- Opening the housing of the device causes the immediate end of the warranty period
- In case of tampering, the compliance with the essential requirements of the applicable directives, for which the device has been certified, is no longer guaranteed
- ekinex® KNX defective devices must be returned to the manufacturer at the following address:

  EKINEX S.p.A.
  Via Novara 37
  I-28010 Miasino (NO) - Italy

7.3 Other information

- This datasheet is aimed at installers, system integrators and planners
- For further information on the product, please contact the ekinex® technical support at the e-mail address support@ekinex.com or visit the website www.ekinex.com
- KNX®and ETS® are registered trademarks of KNX Association cvba, Brussels