SWISS GARDE 360 PRESENCE KNX/KLR

APPLICATION NOTE

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CONTENT

1 FUNCTION DESCRIPTION

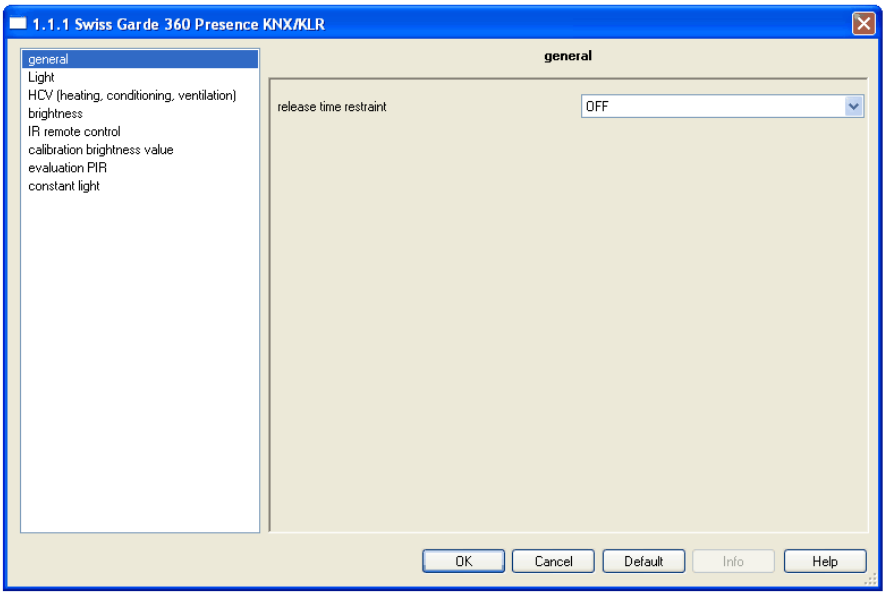
The SWISS GUARD 360P KNX/KLR presence detector for flush ceiling mount features a KNX/EIB interface and is ideal for use in building automation systems.
The device is based on a modern microcontroller with internal flash memory and an integrated KNX/ EIB bus coupler
Four pyro-detectors and a high-resolution lens can detect smallest movements.
The four PIR sensors can be activated individually or in groups.
A cadmium-free light sensor measures brightness and it has a linear output. It's built-in optical filter has a spectral response similar to that of the human eye.
The presence detector has two independent channels for lighting and HVAC control.
The detector can also be switched on and off using a special IR remote control.
Using the standard KNX/EIB bus all switching and control functions can be easily programmed and executed.

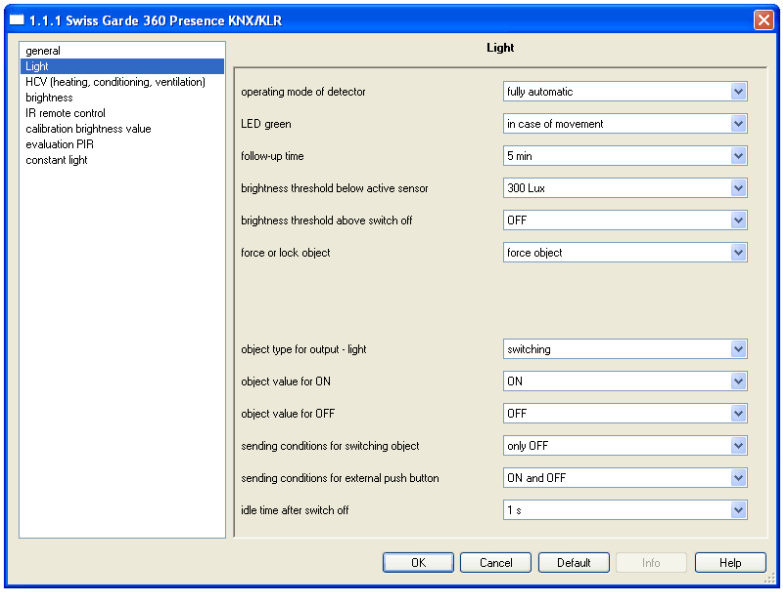
2 COMMUNICATION OBJECTS

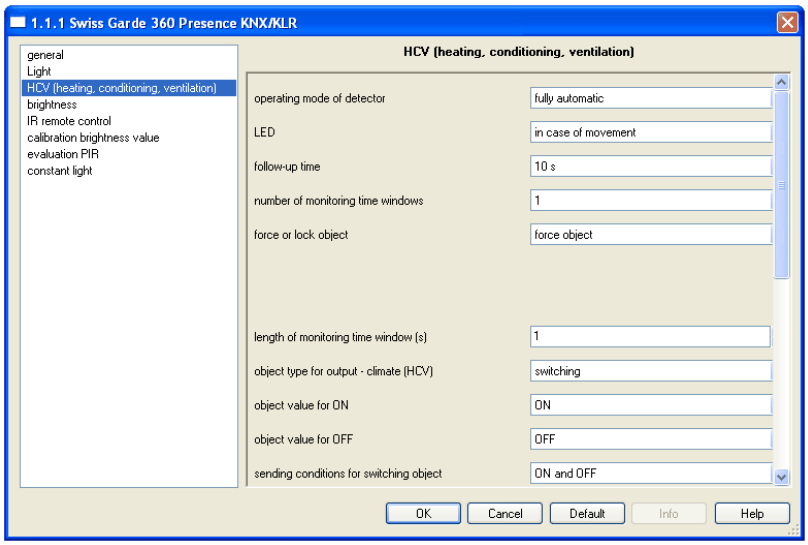
No	Name	in/out	Type	Selection
0	Output - light (dimming absolute)	out	DPT 5.001	1
0	Output - light (switching)	out	DPT1.001	1
0	Output - light (Scene)	out	DPT17.001	1
1	external switch / status - light (switching)	in	DPT 1	
2	external movement / status - light (switching)	in	DPT 1	
3	Input - light (force object)	in	DPT 2.001	2
3	Input - light (lock)	in	DPT 1.001	2
4	Output - HVAC (switching)	out	DPT 1.001	3
4	Output - HVAC (dimming absolute)	out	DPT 5.001	3
4	Output - HVAC (scene)	out	DPT17.001	3
5	External switch / status - HVAC (switching)	in	DPT 1.001	
6	External movement - HVAC (switching)	in	DPT 1.001	
7	Input - HVAC (forced object	in	DPT 1.001	4
7	Input - HVAC (Lock)	in	DPT 1.001	4
8	Brightness threshold (switching)	out	DPT 1.001	
9	Brightness	out	DPT 9.004	
10	AD calibration	in	DPT 7.001	
16	Constant light switching on / off	in	DPT 1.001	
17	Constant light dimming relative	in	DPT 3.007	
18	Constant light dimming absolute	in	DPT 5.001	
20	Constant light forced output	in	DPT 1.001	
21	Constant light scene	in	DPT17.001	
22	Constant light output dimming absolute	out	DPT 5.001	

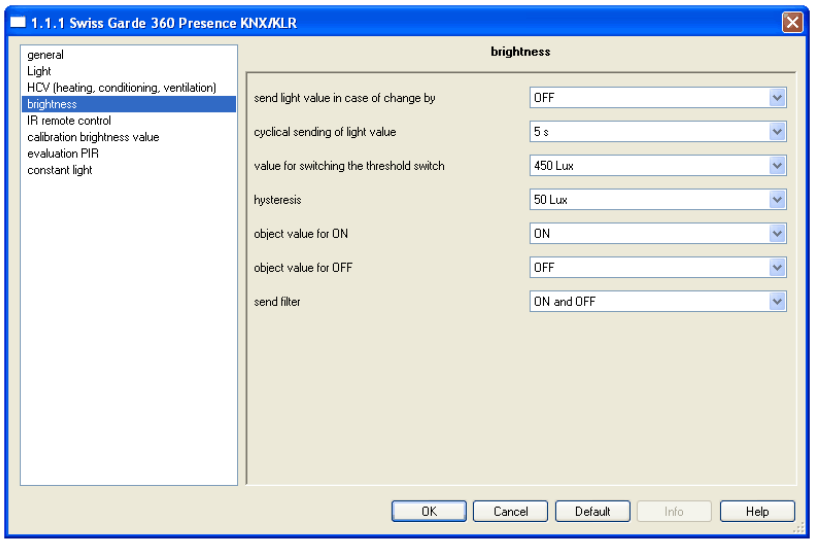
3 PARAMETERS

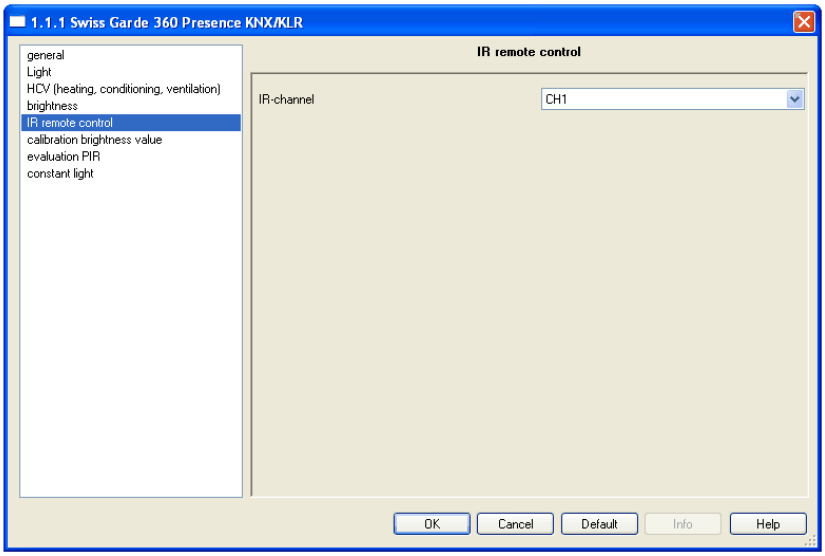
For the setting of the parameters the SG360P KNX/KLR the device must be marked in the configuration or operation mode and select the *Edit* menu or the context menu
(rechte Maustaste) der Befehl *Parameter* auszuwählen. (right click to select) the command *parameters.* This opens the *Edit Parameters* window with multiple tabs ...

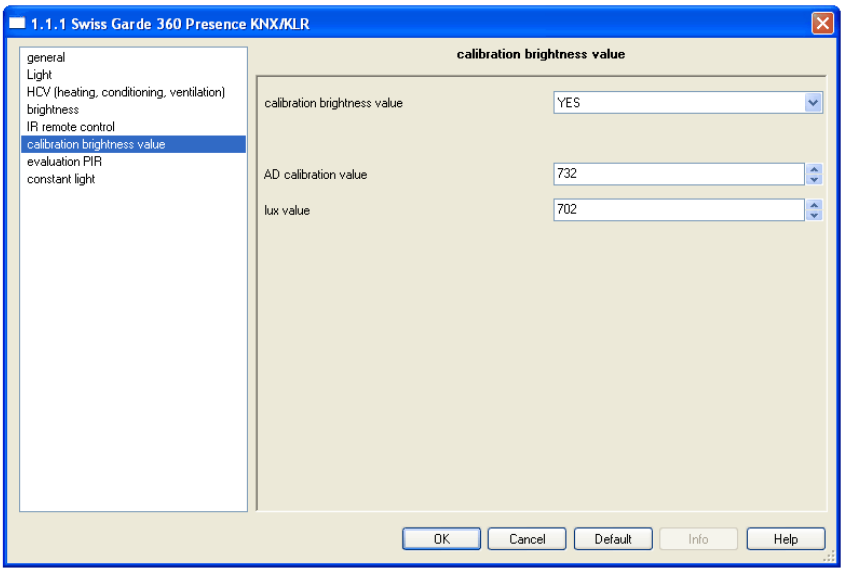
3.1 General	
Release time constraint management	In the menu *release time constraint,* the value can *be set* to "OFF" or a period of 5 min to 9 hrs. This parameter defines the time delay after which the detector resets itself to AUTO mode, eachtime any of the keys OFF or ON or Learn has been pressed.

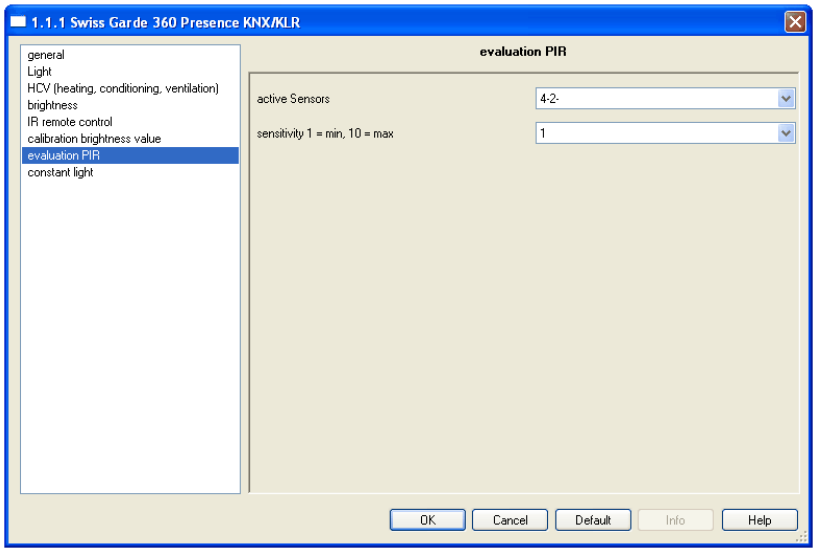
3.2 Lighting	
operation mode of the detector	Defines the the fully automatic or semi-automatic modes.
green LED	This LED can flash once after each motion detection or remain in off status
follow-up time	*The follow-up time* of the light channel can be set from 1s to 4 hrs.
brightness threshold below sensor is active.	Set lighting value from 10 Lux to 2000 Lux. **Important: in master-slave mode all slave detectors must be set to 2000 Lux (motion detection only).**
brightness threshold above lighting is turned off	Brightness threshold above lighting is turned off imedeately, even if the follow-up time has not yet expired.
force object or lock object	This will set object 3. See description of object 3: *force mode – lock mod*
If lock object = 0	Selects action after reception of a 0
If lock object = 1	Selects action after reception of a 1
object type for output - light	This will set object 0. Following parameters can be selected: *switching, dimming absolute, scene.*
object value for ON for object type: *light* = switching *light* = dimming absolute *light* = scene	 select ON or OFF (default is ON) select dim value from 0% to 100% select scenes from 1…32
object value for OFF for object type: *light* = switching *light* = dimming absolute *light* = scene	 select OFF or ON (default is OFF) select dim value from 0% to 100% select scenes from 1…32
sending conditions for switching object	transmission filter for object 0 output – light - switching: selection: ON and OFF, neither ON nor OFF, ON only, OFF only
sending conditions for external push button	selection: ON and OFF, neither ON nor OFF, ON only, OFF only
idle time after switch off	adjustable from 1 s to 60 s applications: • prevention off bus traffic excess • prevention of false lighting restart after: ➢ Cooling light bulbs ➢ leaving the room after switching off with a KNX push button

3.3 HCV	
	All parameters are identical to those of the light channel with the exception of:
number of monitoring time windows	The number of the required monitoring time windows may be set from 1 to 32
length of monitoring time window	Adjustable from 1 s to 30‘0000 s (8.33 hrs)
Attention:	Correct setting for the fastest response of the HVC Channel is: *Number of monitoring time windows*: 1 *length o monitoring time window*: 1s

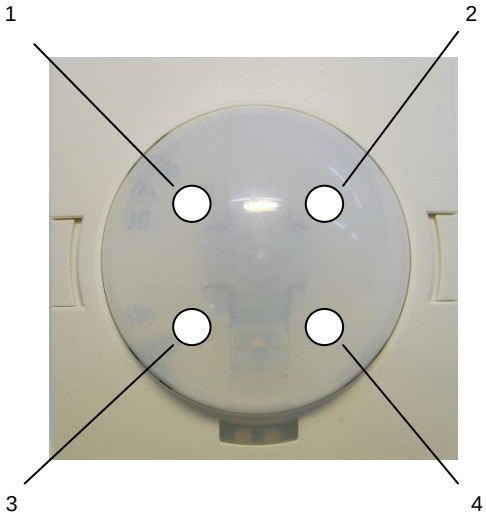
3.4 Brightness / Threshold Switch	
	In the menu **Brightness / Threshold Switch** parameters can be set for the outputs of object 8 *(threshold switch brightness,* 1 bit) and object 9 *(brightness value,* 2 bytes).
send light value in case of change by	With this parameter, the lux value when exceeding the set threshold + change can automatically be sent via the object 9 *(brightness value).* Values from 10 lux up to 1800 lux and "OFF" can be set. The set value of change refers to the set threshold.
cyclic transmission of the light value	Values from 5 seconds to 30 minutes and „OFF“ can be set.
value for switching the threshold	Values from 10 Lux to 2000 Lux can be set.
hysteresis	Values from 5 Lux to 200 Lux can be parameterized
object value for ON	Selection ON or OFF
object value for OFF	Selection OFF or ON
send filter	Selections: „ON and OFF“; „neither ON nor OFF“; „OFF only“; „ON only“

3.5 IR Remote Control	
IR channel	2 transmission channels CH1 and CH2 can be set. The set channel must correspond to the channel set on the IR remote control. Using this feature 2 light groups can be controlled directly and independently of each other.

3.6 Calibration Brightness value	
calibration	„NO“ : factory calibration is enabled (default) Reset to factory calibration: this is possible any time by setting "NO" and subsequent reprogramming of the detector. "YES": this option opens two more windows:
AD calibration value	Read *AD calibration value* (at object 10) in the ETS and register in the window. **Note:** Use ***7 .001 2 byte unsigned counter*** in the menu *value / send* type. The read AD value appears in the menu such as i.e. *value of received:* 739 *pulses*
lux value	Read existing brightness with lux meter and register as reference value in the corresponding window.
	For more details see description of object "AD calibration"

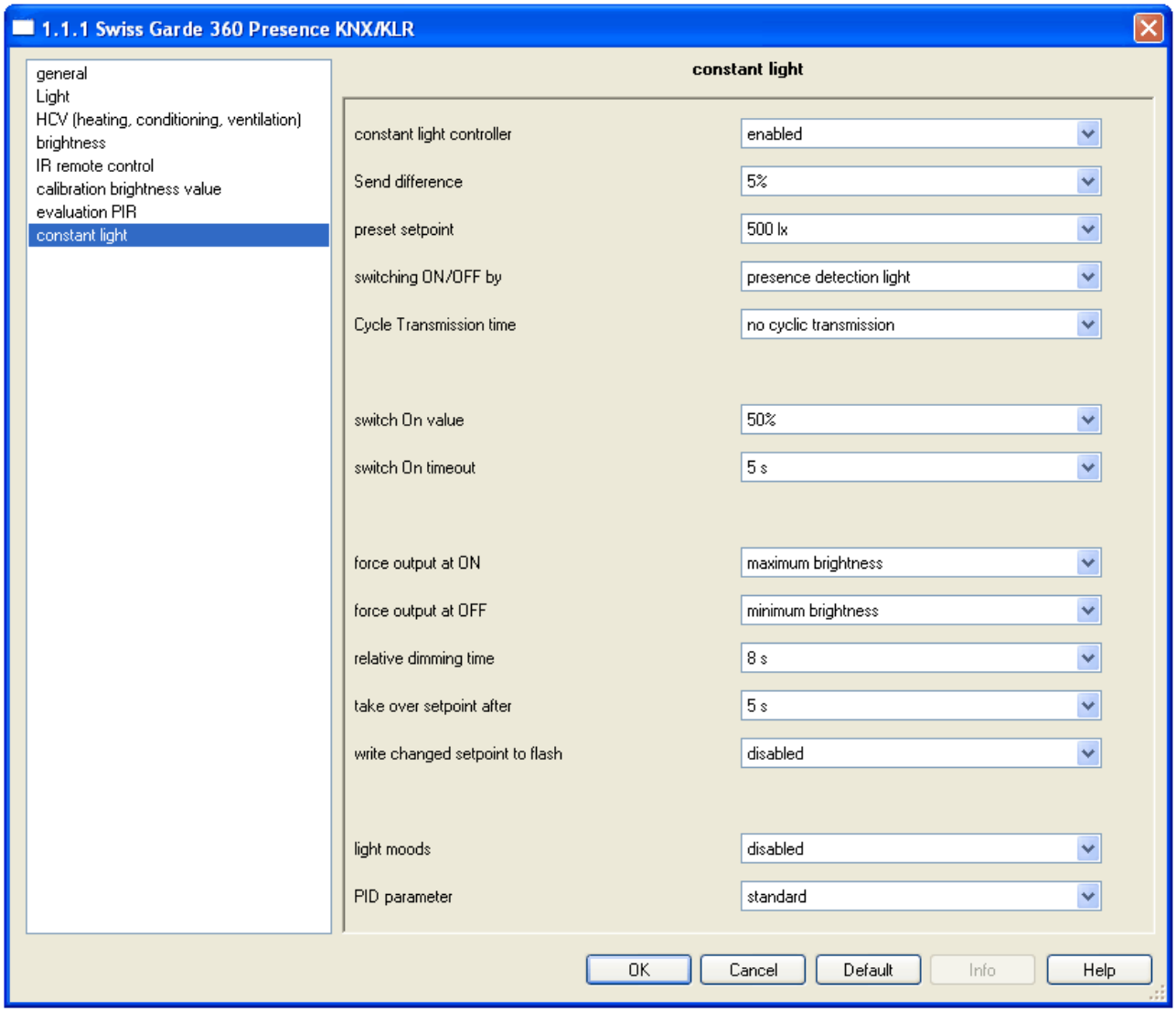
3.7 Evaluation PIR	
active sensors	*The four PIR sensors can be activated individually or in groups. The numbers 1,2,3,4 correspond to the positions 1,2,3,4 in the figure below.*
sensitivity adjustment *1 = minimum, 10 = maximum*	*The sensitivity can be adjusted from 1 to 10* *The default value is 5*

numbering of PIR sensors



The PIR sensors 1 2 3 4 can be activated individually or in groups. The localization of the 4 positions is shown in the figure above.

3.8 Constant light control



3.9 Constant light parameters	
constant light controller	This parameter enables or diables the constant light controller.
send difference	This parameter (from 1% to 100%) determines the tolerance window, which must be exceeded in order to send a new brightness value.
preset setpoint	The setpoint in lux for constant light control can be preset in the ETS. It can also be changed through the objects 17 and 18 (constant light - dimming relative and constant light - dimming absolute).
switching ON/OFF by	Enabling constant light control, i.e.turning on the light can be made from three different sources: object, presence detection light and presence detection HCV.
cycle transmission time	This determines the cycle interval of the last brightness value even if thisone has not exceeded its tolerance window.
switch On value	The switch On value can be set from 1% to 100%.
switch On timeout	This parameter defines the initial delay for starting up of the constant light controller.
force output at ON	With this parameter, the function of constant light controller can be set to: *no reaction, minimum brightness, maximum brightness*
force output at OFF	With this parameter, the function of constant light controller can be set to: *no reaction, minimum brightness, maximum brightness*
relative dimming time	With this parameter, the time for the relative dimming can be set. This has great influence on the dimming softcontrol.
take over setpoint after	This parameter sets the time delay after which a new setpoint will be recognized and stored in the RAM memory.
write changed setpoint to flash	With this parameter a new setpoint can be written to the flash memory.
light moods (light scenes)	Various lux values can be set as light scenes (light moods).These can be enabled through object 21 as well.
PID parameters	The PID parameters have been optimized for most applications and will give good results in standard mode. They should not be changed, if possible. If necessary the PID parameters can be changed by the user (*user defined*). However this requires a deep understanding of control techniques in order to get a fast and stable control system.
Dead band	The deadband is an area within which the actual light value can change without generating new control commands. The default value for the dead band is 2. The lux value of the dead band can be extracted from the table below. <u>Example:</u> Dead band value = 2 Brightness = 500 lux The resulting tolerance is: **+/- 24 lux** This means that the actual value can change from 476 lux to 524 lux without sending new control telegrams to the actor.
Cycle time	The cycle time is specified in milliseconds and corresponds to the interval of updating the control commands.

Short description of control parameters:

parameters	rise time	overshoot	response	error correction
Kp	falling	rising	fast	high
Ki	falling	rising	faster	low
Kd	weak	falling	slower	lowest

Table deadband

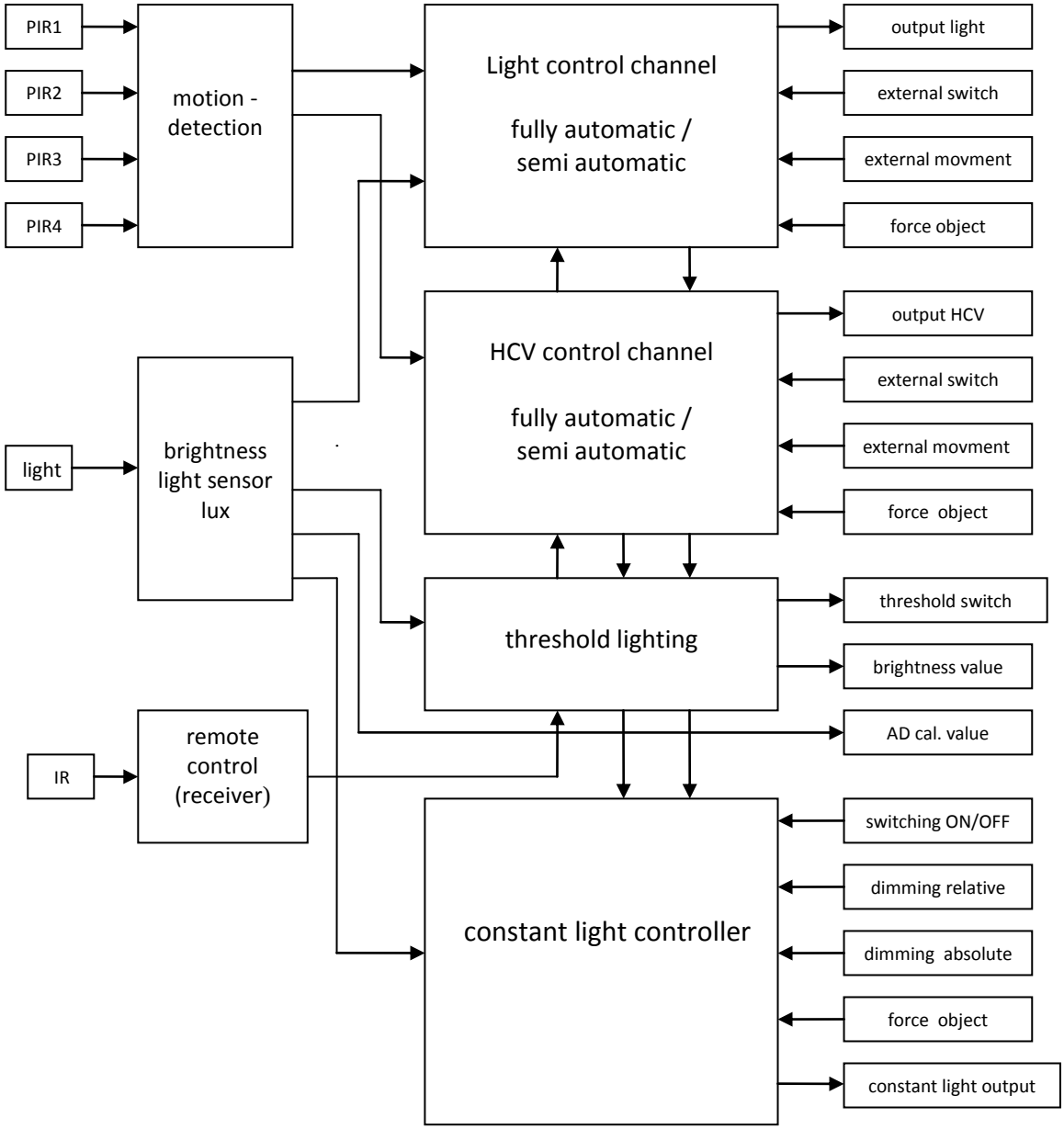
brightness lux **+/- tolerance lux**

		deadband									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
brightness	**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

4 FUNCTIONAL BLOCKS

The functionality of the presence detector can be divided in the following blocks:

- motion detection
- brightness metering
- lighting control channel
- HCV control channel
- threshold lighting
- remote control (receiver)
- constant light controller



The motion detector and the brightness sensor (lux) are connected to the light control channel and the HCV control channel which work independently from each other.

The constant light controller gets the actual brightness value from the light sensor. The start and stop of the constant light controller can be done using communication object 16 or automatically after motion detection with the light or HCV channel.

Initial start behaviour of the presence detector
After power up or after return of the bus voltage, there will be generated a ON telegram on the bus. This is due to the transient response of the internal circuit.

4.1 LIGHT CONTROL CHANNEL

The light control channel has two modes which are set via the parameter *operating mode of detector*.
Available settings are:

- fully automatic
- semi automatic

The differences between *fully automatic* and *semi automatic* operation modes are:

- The fully automatic mode has three operating status: ready, active and passive.
- The semi automatic mode has two operating status: ready and active
- The semi automatic mode does not switch on automatically with motion detection. Light can be switched on only through a external switch.
- In fully automatic operation mode, the IR remote control can send the commands ON, OFF and AUTO through the force object.
- In the semi automatic operating mode, the IR remote control can send the commands ON, OFF only through the external switch input. AUTO has no function here.

The set IR channel (CH1 or CH2) in the ETS Menu must be also set with the slide switch on the back at of the remote control.

4.1.1 OBJECT 0 OUTPUT – LIGHT - SWITCH

After each motion detected this output sends a "ON " command and starts the follow-up timer. The follow up time can be set from 1 s to 4 hrs. At the end of the preprogrammed time interval a “OFF” command ist sent to the output (object 0).

4.1.2 OBJECT 1 EXTERNAL SWITCH / STATUS - LIGHT - SWITCH

Object 1 "external switch / status" can be used in two different ways:

- as an input for a external push button which will switch on the lighting directly.
- as an input for monitoring the status or the input of an actuator.

In both cases, a received telegram „ON“ sets the detector in ON state and a „OFF“ telegram in the ready state. Whether commands for ON or OFF will be sent during the transitions, depends on the parameter *sending conditions for external push button.*
After having received a **ON** command, the follow up timer starts as if a motion had been detected. In the sequence lighting is switched off again.
After having received a **OFF** command the detector remains in its passive status during which it will not detect any motion. After having passed the *idle time after switch off,* the detector is ready again.
The idle time after switch off can be programmed in the **light** menu.

4.1.3 OBJECT 2 EXTERNAL MOVEMENT - LIGHT - SWITCHING

At Object 2 *external movement - light - switching* additional detectors can be connected.
The received signal from external presence detectors is processed the same as it was from its own detector and works in parallel.

Object 2 can be used to set up a **Master-Slave configuration** as follows:

Slaves

Connect **all outputs** of the **slave devices** *output-light-switching* (object 0) to the **input** *external movement-light-switching* (object 2) of the **master device**.

Set the **follow-up time** of **all slave devices** to **1 second** (minimum value).

Set *brightness threshold below active sensor to 2000 lux.*

Set *idle time after switch off* to the required value.

Using this parameter too much traffic on the bus can be inhibited.

Master device:

Connect **input** *external movement-light-switching* (object 2) of the **master device** to all **outputs** *output light-switching* (object 0) of the **slave devices** .

4.1.4 OBJECT 3 INPUT – LIGHT - LOCK

The significance of this object is determined by the parameter *Light for⇨ or lock object.*

force object:

Object 3 used as ***force object*** has 3 values which can be received by a **2 bit command**:

(1) ***force object ON*** (control = 1, value = 1)
A ***ON* command** is sent unconditionally to the *output – light* (object 0).
The follow up timer is disabled and the timer *release time* starts.
If after having terminated the release time and no further command is sent to the force object, normal operation is resumed.

(2) ***force object OFF*** (control = 1, value = 0)
A ***OFF* command** is sent unconditionally to the *output – light* (object 0).
The follow up timer is disabled and the timer *release time* starts.
If after having terminated the release time and no further command is sent to the force object, normal operation is resumed.

(3) ***force object auto*** (control = 0, value = 0)
Normal operation is resumed immediately .

lock object:

Object 3 used as ***lock object*** has 2 values which can be received by a **1 bit command** **0** and **1**:

The response to a switch command on this object is controlled by two more parameters:

Light ⇨ if lock object = 0 , and *Light ⇨ if lock object = 1,*

Both parameters can specify one of the following commands:

- forced ON
- forced OFF
- automatic
- lock (actual state)
- do nothing

Attention!
Incorrect setting of parameters, such as: *lock object*, *lock at 0* and *no action at 1* and *release time restraint OFF* can completely inhibit the correct function of the presence detector.

4.2 HCV CHANNEL (= HVC CHANNEL)

The HCV (heating conditioning ventilation) channel has the same objects and same modes as the light channel. TI works also in the same way as the light channel.
The motion detection function however has been expanded and substituted by a “longer presence detection”. This is done by setting several equally long monitoring time windows. There must occur at least one motion detection during each time slot.

The parameters are:
number of monitoring time windows
length of monitoring time window (s)

The total delay time for an action on the output (object 4) is the multiplication of the two parameters and it can vary as much as one interval of the set *length of monitoring time window.*

4.2.1 OBJECT 4 OUTPUT - HCV - SWITCHING

Object 4: *output climate (HCV) – switching* is similar to object 0 *output-light-switching,* but it has additional functions (see parameters HCV page 8).

4.2.2 OBJECT 5 EXTERNAL SWITCH / STATUS – CLIMATE (HCV) - SWITCHING

Object 5 is identical to object 1 of the light channel.

4.2.3 OBJECT 6 EXTERNAL MOVEMENT – LIGHT - SWITCHING

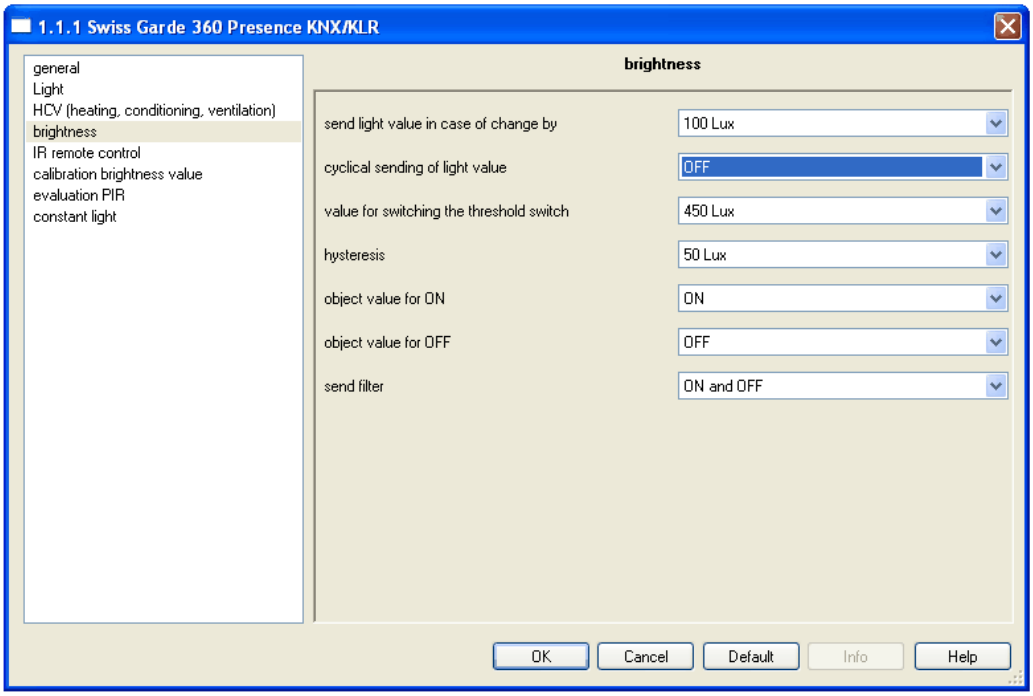
Object 6 is identical to object 2 of the light channel.

4.2.4 OBJECT 7 INPUT – CLIMATE (HCV) - LOCK

Object 7 is identical to object 3 of the light channel.

4.3 BRIGHTNESS THRESHOLD SWITCH

This block has two main output objects (8 and 9) : threshold switch brightness and brightness value.



4.3.1 OBJECT 8 THRESHOLD SWITCH BRIGHTNESS - SWITCHING

Object 8 sends a ON command when the measured brightness is greater than the parameter *value for switching the threshold switch.* When this value drops below the *threshold for switching* **-** (minus) *hysteresis* value a OFF command is sent.

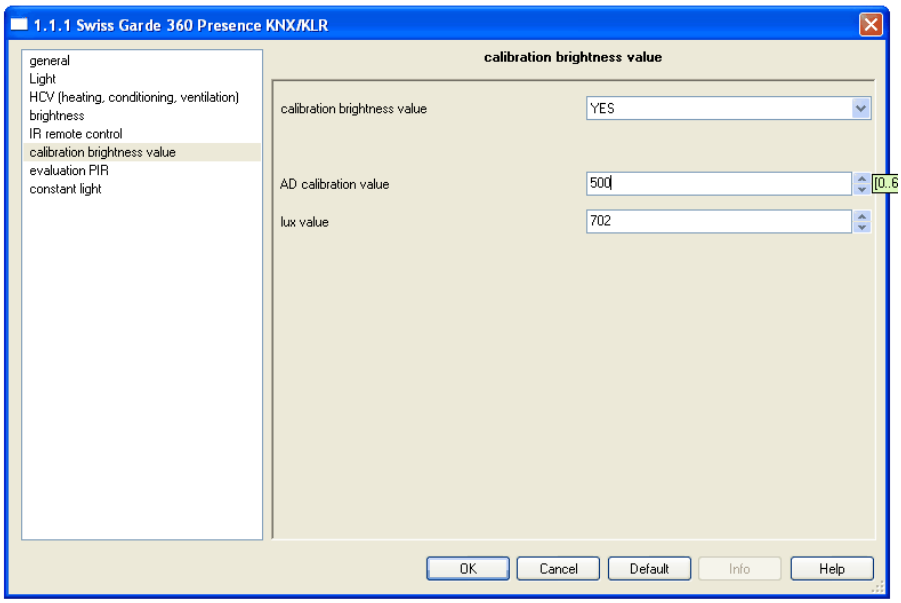
4.3.2 OBJECT 9 BRIGHTNESS VALUE

Object 9 sends the actual measured brightness value in lux. The transmission is initialized eachtime the set parameter *send light value in case of change by* xy is exceeded or if *cyclical sending of light value* has been set to a determined interval in seconds. If *cyclical sending of light* value is set to OFF there will be no cyclical transmission at all.

4.4 AD CALIBRATION

Object 10 *AD calibration* does not transmit automatically. The AD calibration value can only be read. Its unsigned 16 bit number represents the current AD converter value for the brightness.
The brightness measurement can be calibrated as follows:

1. Read actual brightness using a lux meter positioned aside from the motion detector.
2. Read AD calibration value at object 10 using the ETS software tool.
   Please note: : In the ETS menu *value / send* use type 7 ***.001 2 byte unsigned counter***.
   The AD value appears in the menu such as: *received value* 739 ***pulses***
3. Register these two numbers *AD calibration value* and *lux value* in the table under full access .



4.5 IR REMOTE CONTROL

The infrared remote control has 4 buttons with the functions: ON, OFF, AUTO and *Learn.* The commands ON and OFF override the automatic motion detection and they will control the light channel (R1) or the HCV channel (R2), depending on the position of the slider switch at the back of the IR remote control. Additionally two IR transmission channels CH1 or CH2 can be selected.

- In fully automatic mode, the IR remote control will control the force object with the commands ON, OFF and AUTO.
  This corresponds to the reception of the commands on the force objects 3 and 7.
  See description of force object.
- In semi-automatic mode the IR remote control controls the objects 1 and 5 *external switch* with the commands ON or OFF. AUTO has no function here.

- The *Learn* button saves the current brightness value as parameter: *light brightness below which sensor is active.* This new stored lux value overwrites the preset value in the ETS menu!
  This current brightness value corresponds to the desired dusk value for switch off.

4.6 Objects for Constant Light Control

4.6.1 Object 16 Constant Light – Switch ON/OFF

At this input the constant light control can be switched ON and OFF.
With the parameter *switching ON/OFF by* the constant light control can be switched by presence throug the light or HLK channel.

4.6.2 Object 17 Constant Light – Dimming Relative

Using this object, the current value changed with relative dimming steps of 1% .
Using a KNX push button light can be dimmed and set to a new brightnes level.
The new light-current value can then be displayed on a KNX touch panel through object 9: *brightness value.*

Important: In the menu *constant light* ⇨ *take over setpoint after* you can define the the period during which the controller will remain off. After this interval, the new value is written to the RAM (not to the flash memory)!
Warning: This new value remains stored in RAM, even after having switched off the light ouput in the absence of people in the scannedarea.

The default value can only be restored after having made a coldstart with the unit (= BUS voltage reset).

4.6.3 Object 18 Constant Light – Dimming absolute

Using this object the actual setpoint can be changed by sending a new dim value over the bus.

4.6.4 Object 20 Constant Light – Force Output

In accordance to the parameters *force ouput at ON* and *force output at OFF* various options can be selected: no reaction, minimum brightness, maximum brightness

4.6.5 Object 21 Constant Light - Scene

Input constant light-scene. 8 different ajustable scenes can be selected through ETS. This object does not switch it only changes the desired preset brightness value in lux of the scene.

4.6.6 Object 22 Constant Light - Output

With this object you can control a dim actor with absolut dim commands in % of brightness.