Sensors

SR51X000

Programming manual

ingenium*

Bes

www.besknx.com

Index

1   General description

The SR51X000 is a motion detector that has a passive infrared sensor which detects any movement within its detection range. It has a high level of immunity from false alarms, electromagnetic fields and temperature variations. It allows a wide and easy parameterization, being suitable for lighting functions, as well as people detection and intruder control. It also includes an additional channel that can work in dependence of daylight or permanently depending on the parameterization.

These types of detectors are indicated to be placed inside homes, buildings, etc. Avoid installation in places exposed to direct sunlight and drafts. Also, avoid placing these detectors behind large objects as these will reduce their detection range.
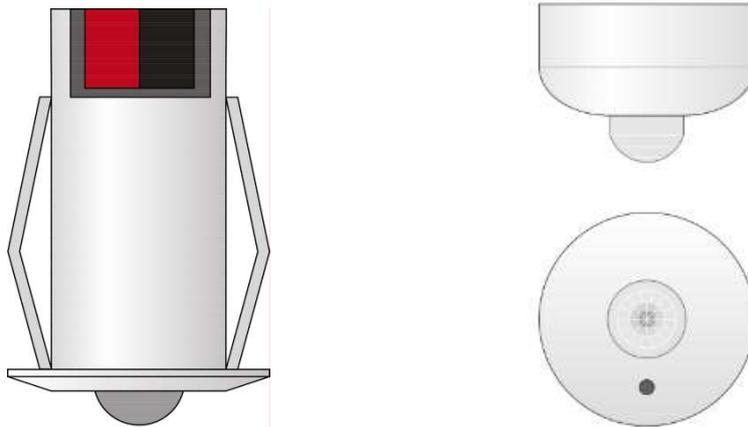
General characteristics:

High immunity infrared passive sensor.

2 detection channels.

Secondary brightness dependent channel.

Embedded installation and discreet sensor.

Brightness level learning function.

2 Technical information

KNX Supply	29Vdc from KNX BUS
KNX current consumption	4mA from KNX BUS
Mounting	Mounted on the ceiling (embedded).
Size	SR510000: Ø Embedded: 25mm / Ø Seen: 36mm / Length: 50mm
	SR511000: *Ø44 x 30 mm*
Connections	BUS connection terminal KNX
Sensor	High immunity infrared passive sensor
Detection range	Ø 5 m at 2.5 m height (see next figure)
Detection channels	2 channels
Brightness sensor	From 0 to 2550 lux
Environment temperature range	Operation: -10ºC/55ºC Storage: -30ºC/60ºC Transportation: -30ºC/60ºC
Regulation	According to the directives of electromagnetic compatibility and low voltage: EN 50090-2-2 / UNE-EN 61000-6-3:2007 / UNE-EN 61000-6-1:2007 / UNE-EN 61010-1.

Ceiling

Detection range
at 2.5m height

Floor

Covered Area: *ø5m*
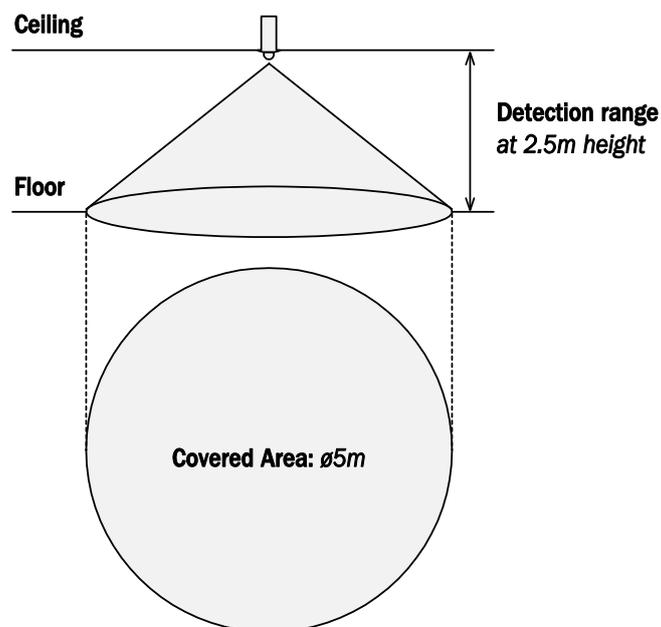
3 Programming

3.1 Application program information

Application program. Bes / SRDS510000 (manufacturer / program name).

Dynamic objects table generation: no.

Maximum number of communication objects: 11.

Maximum number of assignments: 33.

3.2 Communication objects table

Objeto	Nombre / Función	Longitud	DPT	Flags				
				C	R	W	T	U
0	Channel 1 – Motion detection: Bit	1 bit	1.001	●	●		●	
1	Channel 1 - Motion detection: Byte	1 byte	5.010	●	●		●	
2	Channel 1 - Motion detection: Temperature	2 bytes	9.001	●	●		●	
3	Channel 1 - Enable / disable channel	1 bit	1.001	●		●		
4	Channel 1 - Master trigger	1 bit	1.001	●		●		
5	Channel 1 - Remaining time (s)	2 bytes	7.005	●	●		●	
6	Channel 2 - Motion detection: Bit	1 bit	1.001	●	●		●	
7	Channel 2 - Motion detection: Byte	1 byte	5.010	●	●		●	
8	Channel 2 - Motion detection: Temperature	2 bytes	9.001	●	●		●	
9	Channel 2 - Enable / disable channel	1 bit	1.001	●		●		
10	Channel 2 - Master trigger	1 bit	1.001	●		●		
11	Channel 2 - Remaining time (s) / Brightness threshold (lux)	2 bytes	7.013	●	●		●	

3.3 Objects description

Name	Object 0: Channel 1 - Detection event: Bit
Function	1-bit communication object for motion detection in channel 1
Description	When a motion is detected, the sensor is triggered and it sends the correspondent parameter On. When the countdown finishes (switch-off delay) it sends the correspondent parameter Off.

Name	Object 1: Channel 1 - Detection event: Byte
Function	1-byte communication object for motion detection in channel 1
Description	When a motion is detected, the sensor is triggered and it sends the correspondent parameter On. When the countdown finishes (switch-off delay) it sends the correspondent parameter Off.

Name	Object 2: Channel 1 - Detection event: 2 Bytes
Function	2-bytes communication object for motion detection in channel 1
Description	When a motion is detected, the sensor is triggered and it sends the correspondent parameter On. When the countdown finishes (switch-off delay) it sends the correspondent parameter Off.

Name	Object 3: Channel 1 - Enable / disable channel
Function	1-bit communication object for enabling/disabling a channel
Description	1 = Motion detection enabled. 0 = Motion detection disabled (stand-by mode).

Name	Object 4: Channel 1 – Master trigger
Function	1-bit communication object for remote trigger of the sensor
Description	1 = Forces a remote detection. 0 = Forces a remote end of detection. Used for Master-Slave mode. It allows to emulate a detection without any motion. By sending 1, the detector is activated remotely performing the start detection event. Slave sensors emulate Master detections: link bit detection event of the slave with this object of the master.

Name	Object 5: Channel 1 - Remaining time (seconds)
Function	2-bytes communication object for motion reading the remaining time
Description	The remaining time of the countdown after motion detection can be read by this communication object. 0 – 65535 = Remaining time in seconds for end of detection event.

Name	Object 6: Channel 2 - Detection event: Bit
Function	1-bit communication object for motion detection in channel 2
Description	When a motion is detected, the sensor is triggered and it sends the correspondent parameter On. When the countdown finishes (switch-off delay) it sends the correspondent parameter Off.

Name	Object 7: Channel 2 - Detection event: Byte
Function	1-byte communication object for motion detection in channel 2
Description	When a motion is detected, the sensor is triggered and it sends the correspondent parameter On. When the countdown finishes (switch-off delay) it sends the correspondent parameter Off.

Name	Object 8: Channel 2 - Detection event: 2 Bytes
Function	2-bytes communication object for motion detection in channel 1
Description	When a motion is detected, the sensor is triggered and it sends the correspondent parameter On. When the countdown finishes (switch-off delay) it sends the correspondent parameter Off.

Name	Object 9: Channel 2 - Enable / disable channel
Function	1-bit communication object for enabling/disabling a channel
Description	1 = Motion detection enabled. 0 = Motion detection disabled (stand-by mode).

Name	Object 10: Channel 2 - Force remote detection
Function	1-bit communication object for remote trigger of the sensor
Description	1 = Forces a remote detection. 0 = Forces a remote end of detection. Used for Master-Slave mode. It allows to emulate a detection without any motion. By sending 1, the detector is activated remotely performing the start detection event. Slave sensors emulate Master detections: link bit detection event of the slave with this object of the master.

Name	Object 11: Channel 2 –Remaining time / Brightness threshold
Function	2-bytes communication object for reading the remaining time and setting brightness threshold.
Description	This object can have two functions depending on the initial brightness threshold parameter: - **Brightness threshold = 0**: the channel will work as motion sensor (brightness independent). The remaining time of the countdown after motion detection can be read by this communication object. 0 – 65535 = Remaining time in seconds for end of detection event. - **Brightness threshold ≠ 0**: the channel is configured as brightness dependent. Read function: the object answers the current brightness level measured by the sensor (in lux). Write function: Threshold for brightness dependent switching of channel 2 (7.* 2-bytes unsigned value) 1) High byte = 0: Teach-in function. To set the threshold with the current brightness value send 2 bytes raw [0 0] to object. The brightness value is stored and overwrites the previous one. 2) High byte = 1: Manual brightness setting. To set a new threshold manually send 2 bytes raw [1 X] to object, being X the new brightness value from 0 to 255 (x10 lux). For example [1 100] = 1000 lux.

3.4   Parameters

3.4.1   General parameters

General parameters	BUSing address (not used)	41
Channel 1	Advanced: Smoothing	2
Telegrams	Sensitivity (SRKNX) (%) - Brightness threshold CH2 (SifKNX) (*10 lux)	30
Delays	Advanced: Sampling time	16
Channel 2	Advanced Saturation (SRKNX) - Not used (SifKNX)	90
Telegrams		
Delays		

General parameters allow to set the detection characteristics of the sensor and are described as follows:

Name	BUSing Address
Values	From 0 to 255
Description	Not used

Name	Advanced: smoothing
Values	From 0 to 10
Description	It is the value that represents the persistence of the detected movement. This value can range between 0 and 10. The greater value, the more continuous the movement must be for activation to occur. This value must be lesser than or equal to half the Control Cycles parameter. Recommended values depending on usage: – Movement detection (example: activate lighting): 2. – Intrusion detection: 8.

Name	Brightness threshold.
Values	From 0 to 100
Description	Initial brightness threshold factor for brightness dependent switching of channel 2 (value x 10 = lux). For example: 100 = 1000 lux

Name	Advanced: Sampling time
Values	From 0 to 255

Description	This value ranges between 0 and 255, but it is not recommended to be over 64. It represents the number of samplings taken to evaluate a detection. The greater the value, the slower the device response (it is measured in microcontroller cycles, not seconds).
	
	Recommended values depending on usage:
	
	    – Movement detection (example: activate lighting): 16.
	
	    – Intrusion detection: 64

Name	Advanced: Saturation
Values	From 0 to 100
Description	Not used.

3.4.2   Channel 1/2 Events

The configuration of the sensor behavior when there is a motion detection and when it finishes is done here. The working mode and parameterization of both channels is done in the same way and they have similar parameters that are explained next:

Name	Channel 1 / 2 - Motion bit telegram
Values	From 0 to 1
Description	Value sent in object 0/6 (DPT1.00X) when a motion is detected.

Name	Channel 1 / 2 - No motion bit telegram
Values	From 0 to 1
Description	Value sent in object 0/6 (DPT1.00X) after switch-off delay.

Name	Channel 1 / 2 - Motion temperature telegram
Values	From -1000 to 1000 ºC
Description	Value sent in object 2/8 (DPT9.002) when a motion is detected.

Name	Channel 1 / 2 - No motion temperature telegram
Values	From -1000 to 1000 ºC
Description	Value sent in object 2/8 (DPT9.002) after switch-off delay.

Name	Channel 1 / 2 - Motion byte telegram
Values	From 0 to 255
Description	Value sent in object 1/7 (Byte) when a motion is detected.

Name	Channel 1 / 2 - No motion byte telegram
Values	From 0 to 255
Description	Value sent in object 1/7 (Byte) after switch-off delay.

Name	Channel 1 / 2 - Telegrams when motion detection
Values	Yes / No
Description	If this parameter is enabled, after a motion detection, the sensor sends ON telegrams in objects 0,1,2 for channel 1 and objects 6,7,8 for channel 2.

Name	Channel 1 / 2 - Telegrams after motion detection
Values	Yes / No
Description	If this parameter is enabled, if there is no motion within the switch-off delay, the sensor sends OFF telegrams in objects 0, 1, 2 for channel 1 and objects 6,7,8 for channel 2.

Name	Channel 1 / 2 - Off telegrams when channel disable
Values	Yes / No
Description	If this parameter is enabled, after a channel is switched off with objects 3 or 9, the OFF events are sent by objects 0, 1, 2 for channel 1 and objects 6, 7, 8 for channel 2.

3.4.3 Channel 1/2 Delays

These parameters allow to configure time delays when enabling or disabling the sensor and the time that the light is on when the sensor is programmed for lightning control.

Name	Channel enable delay
Values	From 0 to 65535
Description	When enabling the channel it does not respond until the enable delay time set has elapsed.
Name	**Channel disable delay**
Values	From 0 to 65535
Description	When disabling the channel, it keeps detecting motion until the disable delay time set has elapsed.
Name	**Channel switch-off delay**
Values	From 0 to 65535
Description	This parameter is the time between the last motion detection and the sending of switch-off events. In lightning control, the switch-off delay determines how long after a motion is detected the light is to be switched off again. With every motion, the sensor is retriggered and the countdown is re-started, so the light is not switched off until there is no motion within the delay time

3.5   Advanced configuration

3.5.1   Brightness threshold

The SR510000 incorporates a brightness sensor that is able to measure ambient brightness from 0 to 2550 luxes approximately. The brithness threshold value is an initial value introduced by the programmer and it is a factor from 0 to 100 with a base x10 luxes. This means that a threshold from 0 to 1000 luxes can be set initially by programming. The brightness threshold has a hysteresis of 100 (that is, ± 50 lux).

Manual configuration: use the communication object number 11: "Channel 2 – Brightness threshold" to read the current brightness value measured by the sensor once installed in order to set a correct threshold for the lightning switching (Note: If the channel is switched off the brightness level cannot be measured and it will answer a value of 0. Use Object 9 Channel 2 - Enable / disable channel to switch it on.)

Auto configuration: use the teach-in function by sending [0 0] to object number 11 to set the current brightness level as the new brightness threshold.

3.5.2   Smoothing and sampling time

The SR510000 is constantly emitting infrared signals. The movement detection is based on the change which any body, material or thing makes in the infrared signals reflected. These signals are processed and considered as a "motion detection" depending on parameters.

The SR510000 behavior depending on the parameters configured is shown in the next figure:

Any movement that generates a number of pulses higher than the **smoothing**, within a given sampling time, is considered a "motion detection" by the sensor. For the same sampling time, increasing the smoothing means that the movement should be faster and higher to generate a "motion detection" because more pulses are necessary.

The telegrams executed by the sensor when there is a motion detection are sent after every **sampling time,** so increasing the sampling time makes the sensor response slower. If the smoothing does not change, the movement needed to generate a "motion detection" can be the same, but the sensor does not switch on the light after the sampling time.

4   Application notes

4.1   Motion and brightness-dependent switching

4.1.1   Devices

Ref. DS510000: Motion/Brightness double channel sensor.

Ref. CT416400: On/Off actuator with 6 digital inputs and 4 digital outputs.

4.1.2   Description

Light 1 and 2 are connected to outputs 1 and 2 (Z1 and Z2) of the actuator.

The SR510000 controls the light number 1 by motion detection (15 seconds on). The light number 2 will be controlled by motion (20 seconds on) but only when the current brightness value is lower than the configured threshold.

4.1.3   Objects links

Ref. DS510000 📥   Object 0   ->   📥   Object 4 – Ref. 416400

Ref. DS510000 📥   Object 6   ->   📥   Object 6 – Ref. 416400
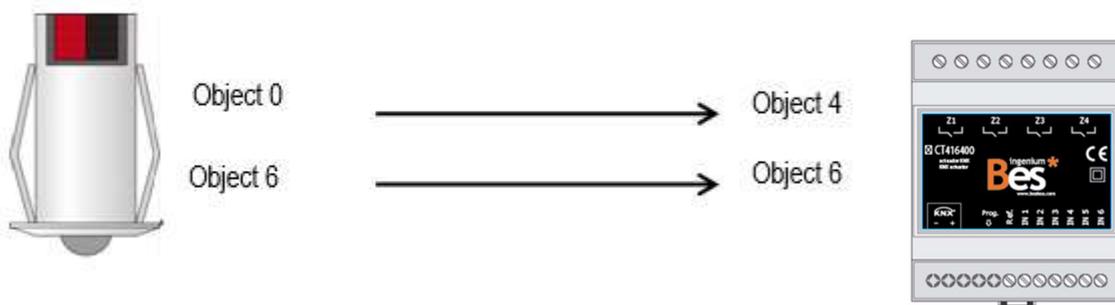
4.1.4   Parameter Settings

The following parameter setting is generally recommended for this example. The ideal parameters may change depending on the application or installation.

Parameter name		Recommended setting
General parameters	Smoothing	2
	Brightness threshold	20
	Sampling time	16
Ch1 Event values	Bit event on	1
	Bit event off	0
	Detection event notification	yes
	End of detection event notification	yes
Ch1 Delays	Channel enable delay	0
	Channel disable delay	0
	Switch-off delay	15
Ch2 Event values	Bit event off	0
	Detection event notification	yes
	End of detection event notification	yes
Ch2 Delays	Channel enable delay	0
	Channel disable delay	0
	Switch-off delay	20

A Smoothing = 2 and Sampling time = 16 are generally recommended for normal lightning control by motion detection. The sensitivity depends on the detection area desired so it must be configured according to the area that should be covered. About the Saturation function, if it is not used it should have a value of 100.

4.2   Master/Slave mode: 1 light y 3 sensors

4.2.1   Devices

3 x Ref. DS510000: Motion/Brightness double channel sensor.

Ref. 416400: On/Off actuator with 6 digital inputs and 4 digital outputs.

4.2.2   Description

A circuit is connected to output 1 (Z1) of the actuator and lights are placed along a corridor. Three SR510000 sensors, one in the middle and another two placed on each side of the corridor will control the lights by motion detection. The lights will be switched on for 60 seconds.
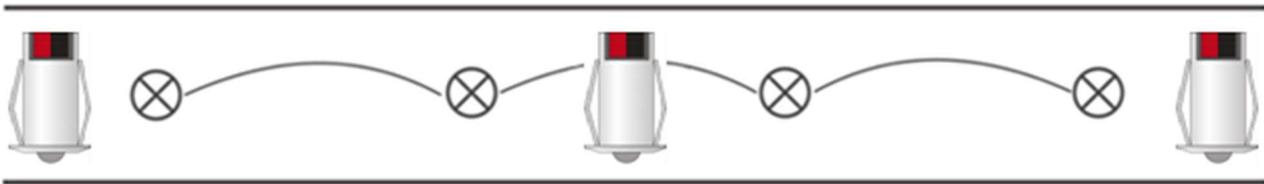
4.2.3   Objects links

Slave 1 Ref. DS510000	Object 0	->	Object 4 – Master Ref. DS510000
Slave 2 Ref. DS510000	Object 0	->	Object 4 – Master Ref. DS510000
Master Ref. DS510000	Object 0	->	Object 4 – Ref. 416400
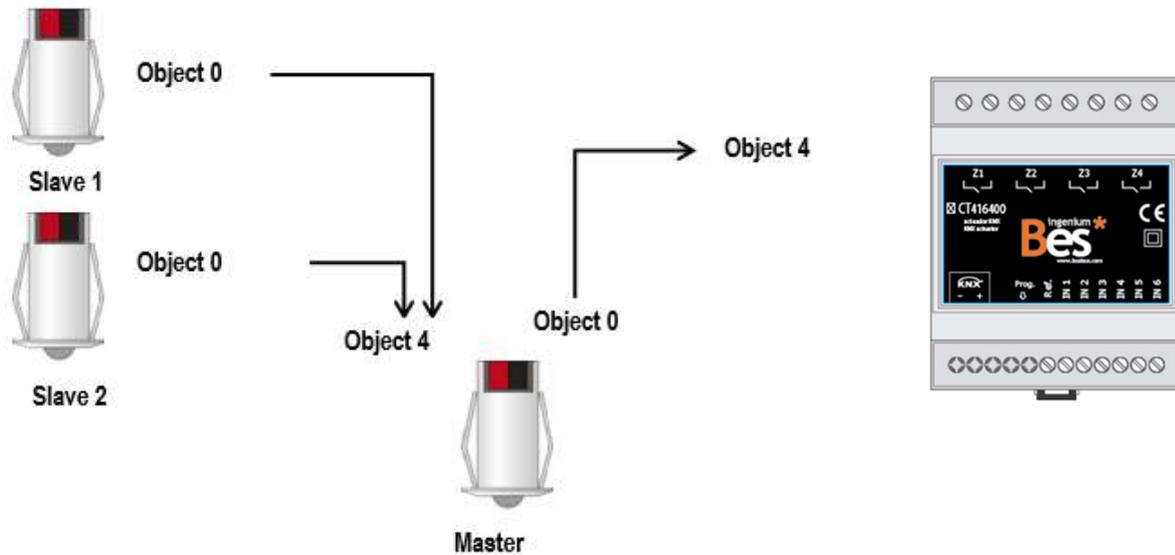
4.2.4 Parameter settings

The following parameter setting is generally recommended for this example. The ideal parameters may change depending on the application or installation.

Parameter name		Recommended setting
Master/Slave	Smoothing	2
General Parameters	Sampling time	16
Master Ch1	Bit event on	1
Event values	Bit event off	0
	Detection event notification	yes
	End of detection event notification	yes
Master Ch1	Channel enable delay	0
Delays	Channel disable delay	0
	Switch-off delay	60
Slave 1 Ch1	Bit event on	1
Event values	Bit event off	0
	Detection event notification	yes
	End of detection event notification	no
Slave 1 Ch1	Channel enable delay	0
Delays	Channel disable delay	0
	Switch-off delay	5

Slave 2 Ch1	Bit event on	1
Event values	Bit event off	0
	Detection event notification	yes
	End of detection event notification	no
Slave 2 Ch1	Channel enable delay	0
Delays	Channel disable delay	0
	Switch-off delay	5

A Smoothing = 2 and Sampling time = 16 are generally recommended for normal lightning control by motion detection.

The switch-off delay of the master is the time that the light is on. The switch-off delay of the slaves should be less in order to send their detections quickly to the master. If there is a huge amount of telegrams in the bus because of the slaves, their sampling times and switch-off delays can be increased.

4.3   Manual on and automatic off

4.3.1   Devices

Ref. DS510000: Motion double channel sensor.

Ref. 416400: On/Off actuator with 6 digital inputs and 4 digital outputs.

KNX Pushbutton.

4.3.2   Description

This function is useful in lobbys, meeting rooms, waiting rooms, etc. If the room is occupied for only a short time no light is required but when the light is switched on it must be guaranteed to switch off when the room is left.

The light of the room is connected to the output 1 (Z1) of the 6E4S-KNX actuator and it should be switched on manually as required with the input of the device (I1) or any other KNX push-button.

The SRKNX controls the lights by motion detection but its sole purpose is to switch off the light after 30 seconds with no movement in the room.

4.3.3   Objects links

Ref. DS510000 ▣⇄│   Objeto 0   -> ▣⇄│   Object 4 – Ref. 416400

KNX Pushbutton – ▣⇄│   Objeto X   -▣⇄│   Object 4 – Ref. 416400
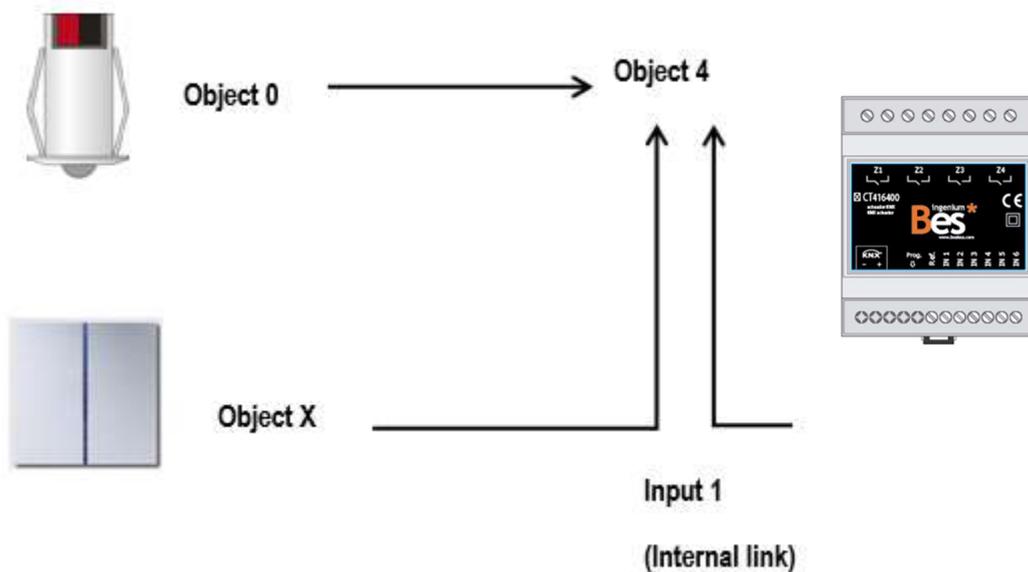
4.3.4 Parameter settings

The following parameter setting is generally recommended for this example. The ideal parameters may change depending on the application or installation.

Parameter name		Recommended setting
General parameters	Smoothing	2
	Sampling time	16
Ch1 Event values	Bit event off	0
	Detection event notification	No
	End of detection event notification	yes
Ch1 Delays	Channel enable delay	0
	Channel disable delay	0
	Switch-off delay	30

A Smoothing = 2 and Sampling time = 16 are generally recommended for normal lightning control by motion detection.

The detection event notification should be disabled because we do not want the sensor to do anything when motion is detected; we only want to switch of the light after 30 seconds without any movement in the room
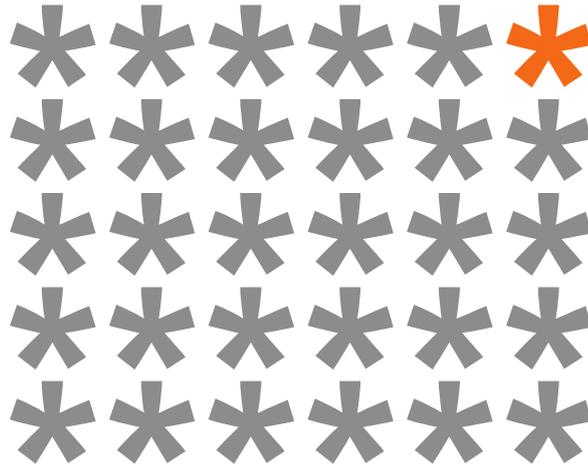
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