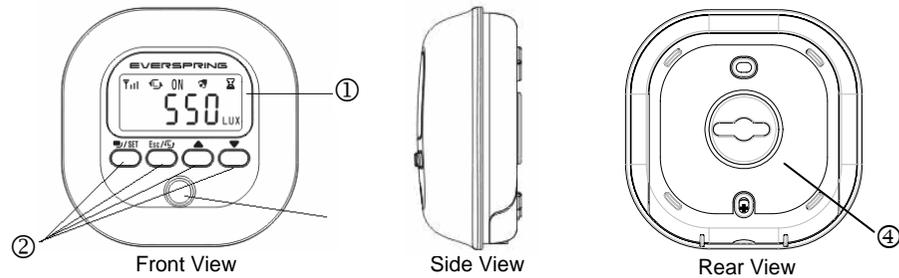


ST815 Illumination Sensor with LCD

The Illumination Sensor with LCD (refer to as Illumination Sensor hereafter) is a Z-Wave™ enabled device which is fully compatible with any Z-Wave™ enabled network. Z-Wave™ enabled devices displaying the Z-Wave™ logo can also be used with it regardless of the manufacturer, and ours can also be used in other manufacturer's Z-Wave™ enabled networks. Inclusion of this sensor on other manufacturer's Wireless Controller menu allows remote operation of connected modules when the sensor is triggered. Z-Wave node in the system also acts as a repeater, so as to re-transmit the RF signal to ensure that the signal is received by its intended destination by routing the signal around obstacles and radio dead spots.

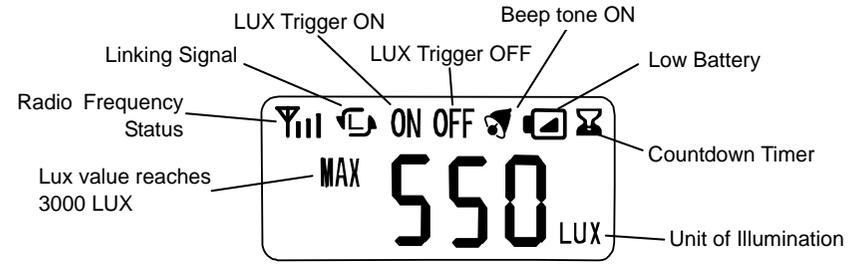
The Illumination Sensor is designed to monitor the current illumination of ambient environment. The reading of illumination can be reported to you on a regular base at your disposal. If illumination reaches set points, the sensor will send alerts to associated devices for further execution (such as trigger on connected lightings). The Illumination Sensor is suitable for use in darkness and outdoor.

Product Overview



① LCD Screen	
② Function Keys	
/ SET	Select modes/Change setting
	Cancel setting/Returning to main display/Learning
	Increase settings/enable RF & beep tone
	Decrease settings/disable RF & beep tone
③ Illumination Sensor	
④ Mounting Bracket	

LCD Display



Include to or Exclude from Z-Wave™ Network



One of function key () is used to carry out inclusion, exclusion, association and reset. When the sensor is first powered up, the reading in RF mode is 00 which implies that it hasn't been allocated a node ID and cannot work with Z-Wave enabled devices. The Illumination Sensor will stay "awake" for 10 minutes when power is first applied to allow time for configuration. Please get familiar with the terms below before starting the operations.

Function	Description
Inclusion	Add a Z-Wave enabled device (e.g. Illumination Sensor) to Z-Wave network.
Exclusion	Delete a Z-Wave enabled device (e.g. Illumination Sensor) from the network.
Association	After inclusion, you have to define the relationship between devices. Through association, device can be assigned as master/slave, and specify which slave is going to be controlled by which master.
Reset	Restore Illumination Sensor to factory default.

The table below lists an operation summary of basic Z-Wave functions. Please refer to the instructions for your Z-Wave™ Certified Primary Controller to access the setup function, and to include/exclude/associate devices.

Function	Description	LCD Indication
No node ID	The Z-Wave Controller does not allocate a node ID to the sensor.	The RF reading displays 00 (MODE 5)
Inclusion	1. Have Z-Wave Controller entered inclusion mode. 2. Pressing key 3 times within 1.5 seconds will enter inclusion mode.	flashes

Function	Description	LCD Indication
Exclusion	1. Have Z-Wave Controller entered exclusion mode.	☐ flashes
	2. Pressing ESC/ key 3 times within 1.5 seconds will enter exclusion mode.	
	Node ID has been excluded.	The RF reading displays 00 (MODE 5)
Reset	1. Pressing ESC/ key 3 times within 1.5 seconds will enter inclusion mode.	Long beep tone is sounded as an indication of completion.
	2. Within 1 second, press ESC/ key again and hold it until long beep tone is off.	
	3. Node ID has been excluded, restores to factory default.	The RF reading displays 00 (MODE 5)
Association	1. Have Z-Wave Controller entered association mode.	☐ flashes
	2. Pressing ESC/ key 3 times within 1.5 seconds will enter association mode.	
	3. There are two groupings – 1 and 2. Refer to Z-Wave's Groupings as described on page 5.	
※ Including a node ID allocated by Z-Wave Controller means inclusion. Excluding a node ID allocated by Z-Wave Controller means exclusion. ※ Failed or success in including/excluding the node ID can be viewed from the Z-Wave Controller.		

Choosing a Suitable Location

The Illumination Sensor can either be mounted on a wall or can be freestanding on a table. Please consider a most suitable way before mounting/placing it.

Wall Mounting

1. Place mounting bracket over a desired location on the wall. Through 2 screw holes of the bracket, mark the mounting surface with a pencil.
2. Where marked, drill holes into mounting surface using an appropriate size drill bit and insert the plastic wall plugs supplied respectively.
3. Screw mounting bracket onto the mounting surface. Ensure that the screws are flush with the bracket.
4. Snap the Illumination Sensor into place on the mounting bracket.
5. Secure with the fixing screw supplied.

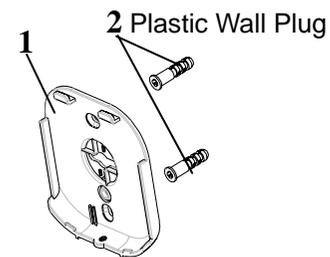


FIGURE 1

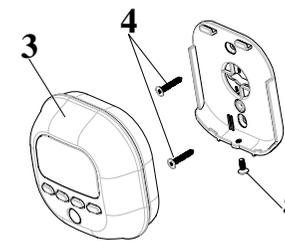


FIGURE 2

Table Placing

1. Insert the stand into the hole on mounting bracket and turn 90 degrees clockwise.
2. Once snapped in place, the sensor can be placed on a shelf, table or other surface where the illumination measurements are desired.

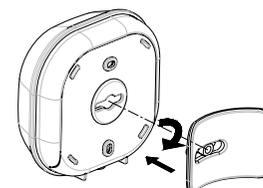


FIGURE 3

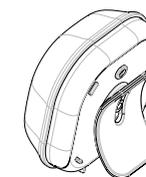
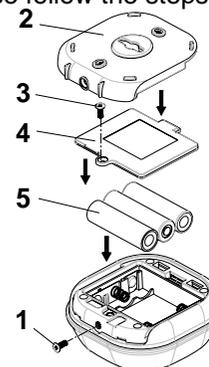


FIGURE 4

Note: Take care when fixing the sensor to a metal surface, or mounting within 1m of metalwork (i.e. radiators, water pipes, etc) as this could affect the radio range of the device.

Installation

Please follow the steps below in sequence to load the batteries.



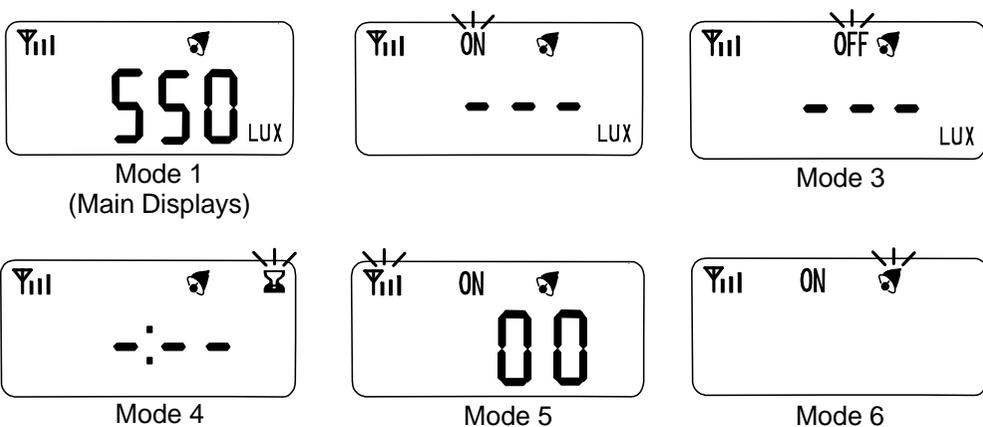
1. Undo and remove the screw from the bottom edge of the sensor to detach the rear cover.
2. Open the mounting bracket.
3. Unscrew the screw from the battery cover.
4. Remove the battery cover.

FIGURE 5

5. Insert 3 AA-size 1.5V alkaline batteries to the battery compartment, ensuring correct polarity is put.
6. Replace the battery cover and then engage the sensor to the rear cover firmly.

Operation

There are 6 modes available for selection. Press **SET** to select desired mode for different settings.



Mode	Function
1	Current illumination display (LUX)
2	Setting for lux trigger-ON value
3	Setting for lux trigger-OFF value
4	Countdown timer
5	Setting for turning on/off radio frequency
6	Setting for tuning on/off beep tone

MODE 1 is showing as main display on the screen. Once mode setting is finished (MODE 2 to MODE 6), the screen will return to main display automatically after 12 seconds, or by pressing **ESC** to return to main display.

1. Illumination

1.1 Display of Current Illumination

After power-up (batteries are inserted), the LCD screen displays the current illumination. All icons are displayed with LCD backlight illuminates 3 seconds.

Press any key will beep once and extend the backlight for another 12 seconds. The illumination **detecting range** is from **0** to **3000** LUX. When illumination reaches the limit (3000 LUX), **MAX** icon will be displayed on the screen.

The detecting function is disabled while you are operating the sensor. Wait for 12 seconds to enable trigger-ON or trigger-OFF function. If trigger-ON or trigger-OFF value has already been set, detecting function will be enabled 10 seconds after sensor is re-powered.

1.2 Lux Trigger-ON

Press **SET** and select MODE 2 to enter setting of lux trigger-ON. Icon **ON** flashes and the screen shows the recorded trigger-ON lux. If no value is preset, the screen will display “ - - - LUX”.

To adjust trigger-ON value, press and hold **SET** for 5 seconds until a long beep is sounded. The “ - - -” starts flashing. Use **▲** and **▼** button to adjust the lux value, and hold **▲** or **▼** button to scan through the lux reading from 30 to 1000 (the lux value can only be adjusted on the basis of 10 LUX per unit; the default value is 300 LUX). Once the value is selected, press **SET** to confirm setting or press **ESC** to cancel.

To clear the trigger-ON record, press both **▲** and **▼** at the same time. The record is cleared after a long beep is sounded.

If lux of ambient light is lower than the preset trigger-ON value, Illumination Sensor will emit RF signal to the nodes of Grouping 2. The screen of sensor will return to MODE 1 and the icon **ON** is flashing with backlight illuminates and 4 continuous beep sound for 1 second. Press any key to stop the beep tone.

To avoid the problem of consecutive triggering, once Illumination Sensor has been triggered, it has to be placed still for 2 minutes (restriction) before lux trigger-ON is enabled again. To clear this restriction, the detected lux value of ambient light during this two-minute period **MUST** be higher than the preset trigger-ON value, otherwise the sensor will keep recounting 2 minutes before it can be triggered again (FIGURE 6).

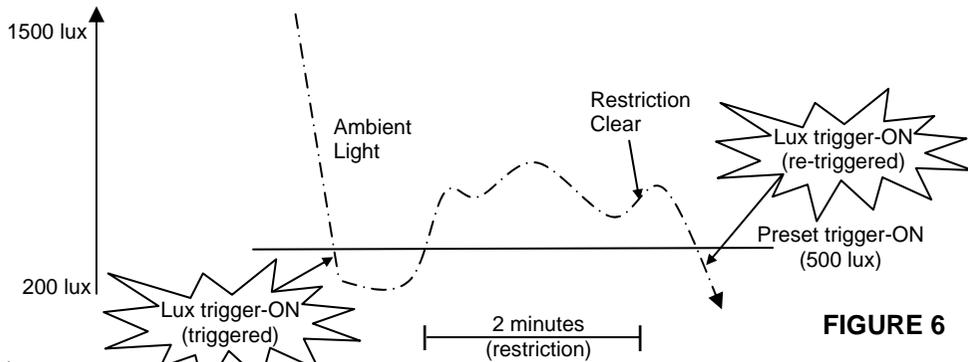


FIGURE 6

- Note:**
- × If no key has been pressed, it will return to MODE 1 automatically after 12 seconds.
 - × While you are setting the sensor, the function of detecting trigger-ON is set to disable to avoid false detection (because hands may obstruct the light to Illumination Sensor during setting). The sensor must be placed still for 12 seconds for the detecting function to be enabled again. If trigger-ON value is preset and the sensor is re-powered, it will take 10 seconds before the detecting function is enabled.
 - × The lux trigger-ON and trigger-OFF cannot be set equal; there MUST be at least 100 LUX differences between them. For example, if now the trigger-OFF lux is already set to be 200 LUX, so trigger-ON lux can only be set ≤ 100 LUX or ≥ 300 LUX (values between 100 LUX and 300 LUX cannot be set).

1.3 Lux Trigger-OFF

Press **SET** and select MODE 3 to enter setting of lux trigger-OFF. Icon OFF flashes and the screen shows the recorded trigger-OFF lux. If no value is preset, the screen will display " - - - LUX".

To adjust trigger-OFF value, press and hold **SET** for 5 seconds until a long beep is sounded. The " - - -" starts flashing. Use **▲** and **▼** button to adjust the lux value, and hold **▲** or **▼** button to scan through the lux reading from 30 to 1000 (the lux value can only be adjusted on the basis of 10 LUX per unit; the default value is 300 LUX). Once the value is selected, press **SET** to confirm setting or press **ESC** to cancel.

To clear the trigger-OFF record, press both **▲** and **▼** at the same time. The record is cleared after a long beep is sounded.

If lux of ambient light is greater than preset trigger-OFF value, Illumination Sensor will emit RF signal to the nodes of Grouping 2. The screen of sensor will return to MODE 1 and the icon OFF is flashing with backlight illuminates and 4 continuous beeps sound for 1 second. Press any key to stop the beep tone.

A mechanism of 12-second placing still is designed to prevent the sensor being triggered rapidly. Suppose the ambient light is changing rapidly, if trigger-ON value is preset and has been triggered, and the ambient light has reached a lux level that is higher than preset trigger-OFF value soon after, the sensor will not be triggered. If 12 seconds later the lux level is still higher than the preset trigger-OFF value, the sensor will be then triggered. Please refer to FIGURE 7 for illustration of how the mechanism operates.

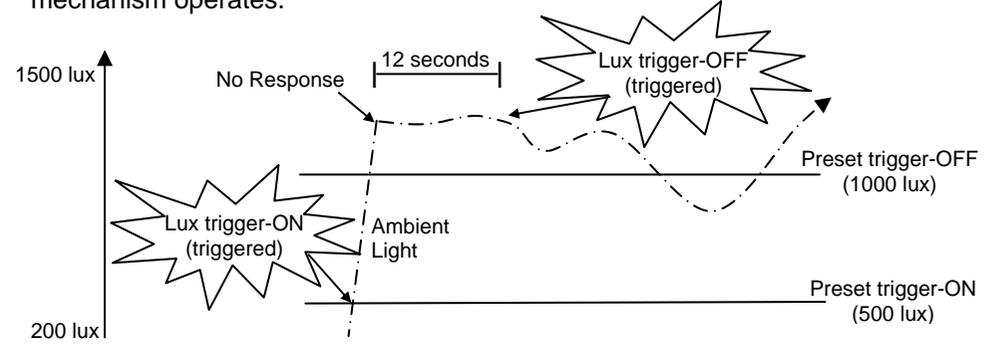


FIGURE 7

If no trigger-ON value is preset, to avoid the problem of consecutive triggering, the sensor has to be placed still for 2 minutes (restriction) before lux trigger-OFF is enabled again. To clear this restriction, the detected lux value of ambient light during this 2-minute period MUST be lower than the preset trigger-OFF value, otherwise the sensor will keep recounting the time before it can be triggered again (FIGURE 8).

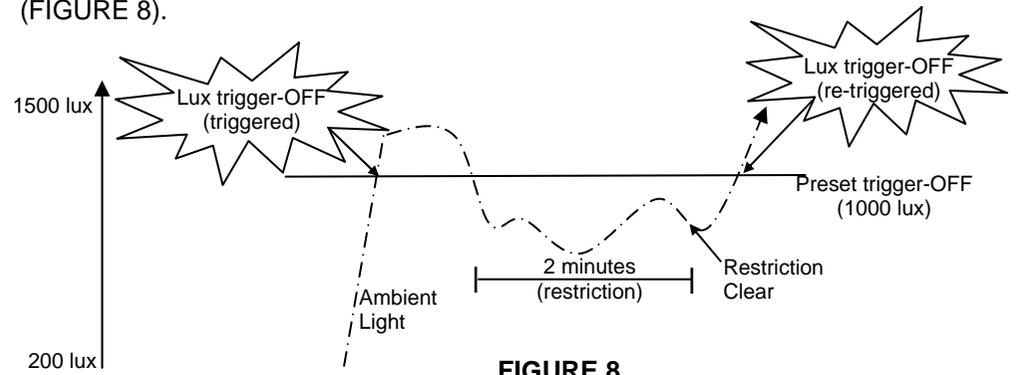


FIGURE 8

Note:

- × If no key has been pressed, it will return to MODE 1 automatically after 12 seconds.
- × While you are setting the sensor, the function of detecting trigger-OFF is set to disable to avoid false detection (because hands may obstruct the light to Illumination Sensor during setting). The sensor must be placed still for 12 seconds for the detecting function to be enabled again. If trigger-OFF value is preset and the sensor is re-powered, it will take 10 seconds before the detecting function is enabled.
- × The lux trigger-ON and trigger-OFF cannot be set equal; there MUST be at least 100 LUX differences between them. For example, if now the trigger-ON lux is already set to be 200 LUX, so trigger-OFF lux can only be set ≤ 100 LUX or ≥ 300 LUX (values between 100 LUX and 300 LUX cannot be set).

2. Countdown Timer

Press **SET** and select MODE 4 to enter setting of countdown time. Icon  flashes and the screen shows the recorded countdown time. If no value is preset, the screen will display “- : -”.

To adjust countdown time, press and hold **SET** for 5 seconds until a long beep is sounded. The hour starts flashing.



Use **▲** and **▼** button to adjust the countdown time, and hold **▲** or **▼** button to scan through the time from 1 hour to 8 hours. Press **SET** to set minutes, and hold **▲** or **▼** button to scan through the time from 1 minute to 60 minutes. Once the value is selected, press **SET** to confirm setting or press **ESC**/ to cancel.

To clear the last countdown time record, press both **▲** and **▼** at the same time. The record is cleared after a long beep is sounded.

Countdown timer starts counting ONLY when the trigger-ON lux is triggered. No response will be made if sensor is triggered ON again during countdown period. Wait till countdown is completed before restarting the trigger-ON function.

Once countdown is completed, icon **OFF** flashes on the screen with LCD backlight on and 4 continuous beeps sound for 1 second. The sensor will emit RF signal to the nodes in Grouping 2. The sensor has to be place still for 2 minutes before lux trigger-ON is enabled again. To clear this restriction, the detected lux of ambient

light during this 2 minutes period MUST be higher than the preset trigger-ON value, otherwise the sensor will keep recounting for 2 minutes before it can be triggered again.

Note:

- × If no key has been pressed, it will return to MODE 1 automatically after 12 seconds.
- × While you are setting the sensor, the function of detecting trigger-ON is set to disable to avoid false detection.
- × The countdown bias is about $\pm 10\%$.

3. Radio Frequency

This function is designed to enable or disable the sending function of RF command to the associated nodes in Grouping 2 once Illumination Sensor has been triggered ON/OFF.

Press **SET** and select MODE 5, the icon  should flash. Press **▲** to turn On (enable) the function or **▼** to turn OFF (disable) the function.

Note:

- × If RF mode is OFF, no command will be sent even the Illumination Sensor has been triggered.
- × If RF reading is 00, it implies no node ID has been allocated by Z-Wave Controller. Please execute inclusion mode as described on page 1.

4. Beep Tone

To set the beep tone, press **SET** and select MODE 6. The icon  flashes. Press **▲** for ON and **▼** for OFF. If it is ON, a beep tone will be sounded whenever a button is pressed; 4 continuous beeps will be sounded for 1 second if the sensor has been triggered.

Programming

1. Z-Wave's Groups (Association Command Class Version 2)

The Illumination Sensor can be set to send reports to or control associated Z-Wave devices. It supports two association groups with one node support for Grouping 1 and three nodes support for Grouping 2.

Grouping 1 includes POWER_APPLIED, SENSOR_MULTILEVEL_REPORT, ALARM_REPORT and BATTERY_REPORT_COMMAND

Grouping 2 includes BASIC_SET

1-1 Grouping 1 (Max. Node = 1)

1-1-1 POWER_APPLIED command

Whenever power is applied, it will send ALARM_REPORT command to the nodes of Grouping 1 to inform associated devices that the sensor is powered up.

ALARM_REPORT Command
[Command Class Alarm, Alarm Type = 0x02, Alarm Level = 0x01]

1-1-2 MULTILEVEL_SENSOR_REPORT

The sensor will emit SENSOR_MULTILEVEL_REPORT to inform the nodes of Grouping 1 automatically its current lux. Refer to the section of Z-Wave's Configuration for settings of auto report and wakeup configuration.

Illumination:

SENSOR_MULTILEVEL_REPORT
[Command Class Sensor Multilevel, Sensor Multilevel Report, Sensor Type = 0 x 03 (Luminance), Precision+Scale+Size = 0 x 0A, Sensor Value 1 = (High Byte of Illumination Value), Sensor Value 2 = (Low Byte of Illumination Value)]

Example:

Sensor Value 1 = 0x08

Sensor Value 2 = 0x02

Illumination = (Sensor Value 1 * 256 + Sensor Value 2)
= (8 * 256 + 2) = 2050 (LUX)

1-1-3 Low Battery Report

When the battery level of the sensor drops to an unacceptable level, the icon  will appear on the LCD and the sensor will emit ALARM_REPORT command to the nodes of Grouping 1.

ALARM_REPORT Command:

[Command Class Alarm, Alarm Type = 0x01, Alarm Level = 255(0xFF)]

The users can also enquire the battery status of the sensor by sending BATTERY_GET command via controller. Once the sensor receives the command, it will return BATTERY_REPORT command.

BATTERY_REPORT Command

[Command Class Battery, Battery Report, Battery Level = 20%-100%]

If it displays with a message of "Battery Level = 255 (0xFF)", it implies that the sensor is at low battery status. Please replace the batteries as soon as possible, otherwise the sensor will enter Shut Down mode.

Note:

- × The sensor will emit a low battery command as long as there is a device associated into Grouping 1 of Illumination Sensor, even if the RF function is set to disable.
- × If sensor enters Shut Down mode, the LCD display will be extinguished and no RF signal will be emitted.

1-2 Grouping 2 (Max. Node = 3)

1-2-1 BASIC_SET

When the sensor is triggered, it will emit BASIC_SET_COMMAND to the nodes of Grouping 2.

[Command Class Basic, Basic Set, Value = (255)0xFF]: send trigger-ON command

[Command Class Basic, Basic Set, Value = 0(0x00)]: send trigger-OFF command

Please refer to the table below, configuration parameter 1, for the setting of basic set command.

2. Z-Wave's Configuration

The table below lists the configuration parameters and the value range for users to set up the sensor.

Parameter	Function	Size (Byte)	Value	Unit	Default Set/ Factory Default	Description
1	Basic Set Level	1	0~99	% of Brightness (Dimmer Level)	99 / 99	Set basic set value to be on (or set Lux Level)/off 0: Disable
2	Lux Trigger-ON Value	2	30~1000 or 0	LUX	300 / 0	Set lux trigger-ON value to be _LUX. 0: Clear lux trigger-ON value
3	Lux Trigger-OFF Value	2	30~1000 or 0	LUX	500 / 0	Set lux trigger-OFF value to be _LUX. 0: Clear lux trigger-OFF value
4	Lux Trigger-OFF (Timer Value)	2	1~480 or 0	Minute	240 / 0	Set lux trigger-OFF value to be _LUX. 0: Clear lux trigger-OFF value
5	Auto Report (Time Interval)	2	1~1439 or 0	Minutes	0 / 0	Set auto report time interval to be _mins 0: Disable auto report
6	Auto Report (Lux Interval)	2	30~1000 or 0	LUX	0 / 0	Enable auto report 0: Disable auto report

Note:

※ Default set is the preset value of the sensor. For instance, if default set of LUX Trigger-ON is selected as 30 LUX, the sensor will be triggered ON if sensor reaches 30 LUX. You can skip the hassle of selecting a value from 30 to 1000 degrees if default set is selected.

※ Factory default value is the original value of the sensor without any setting. Once the function of reset is executed, the sensor will be restored to its factory default status, so as the settings.

2-1 Auto Report

2-1-1 Time Interval

The Illumination Sensor can be set to emit report of current status to the nodes of Grouping 1 automatically at a set time. The time interval can be set from 1 minute to 23 hours 59 minutes. For instance, if time interval is

set in 1 minute, the sensor will report its status once per minute. Please refer to the parameter 5 of configuration table.

2-1-2 Change of Lux Value

The sensor can be set to emit report of lux status to the nodes of Grouping 1 automatically once the ambient light changing exceeds set value. The lux difference range can be set from 30 to 1000 LUX. For instance, if difference of lux value is set in 100 LUX, the sensor will report its current lux value once the difference exceeds 100 LUX. Please refer to the parameter 6 of configuration table.

Note: Auto report mechanism may cause a lot of power consumption if it operates regularly. Please base on actual requirements for determining whether to enable the function of auto report or not.

2-2 Wakeup Configuration

The Illumination Sensor stays in sleep status for the majority of time in order to conserve battery power. However, it can be woken up by either triggers of Illumination Sensor or set time for the controller to do further setting. If sleep time is over, the sensor will emit Wake Up Notification command to the controller automatically.

2-2-1 Wakeup Time Interval

The sensor stays in wakeup status for 10 seconds. If the sensor receives RF command from the controller during these 10 seconds, it will extend waking time for another 10 seconds until no more RF command is received. If it receives "Wake Up no More Information" or the wakeup time is up, the sensor goes back to sleep status.

2-2-2 Sleep Time Interval

The sleep interval can be set from 1 minute to 4660 hours (about 194 days). The unit of time is in seconds. The preset interval of sleep time is 1 hour.

3. Command Classes

The Illustration Sensor supports Command Classes including...

- * COMMAND_CLASS_BASIC
- * COMMAND_CLASS_VERISON

- * COMMAND_CLASS_BATTERY
- * COMMAND_CLASS_WAKE_UP_V2
- * COMMAND_CLASS_CONFIGURATION
- * COMMAND_CLASS_ASSOCIATION_V2
- * COMMAND_CLASS_MANUFACTURER_SPECIFIC
- * COMMAND_CLASS_SENSOR_MULTILEVEL

Troubleshooting

Symptom	Possible Cause	Recommendation
LCD cannot be displayed	1. Run out of battery power. 2. Check if reverse battery polarity	1. Replace a new battery 2. Refit the battery with correct polarity
	Pressing buttons are damaged	Do not open the sensor; send it to the local retailer.
Illumination Sensor reading is inaccurate	The sensor is out of order	1. Please leave the sensor without operating or do any setting for a period 2. Do not open the sensor; send it to the local retailer.
	This product does not provide exact reading; the reading of lux value is used for your reference only for environmental illumination setting.	

Specifications

Operating Frequency	868.42 (ST815-1) / 908.42 (ST815-2)
Illumination Detecting Range	0 ~ 3000 LUX
Luminance Unit	LUX
Protection Degree	IP44 (indoor & outdoor use)
Error Range	> 1000 LUX ± 320 LUX < 1000 LUX ± 200 LUX
Battery Type	1.5V x 3 Alkaline/AA type battery
Operating Range	Up to 30 meters line of sight (indoor)
ZDK Version	V5.02

*Specifications are subject to change without notice

A501111535R



Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

WARNING:

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.

Contact your local government for information regarding the collection systems available.

If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being.

When replacing old appliances with new once, the retailer is legally obligated to take back your old appliance for disposal at least for free of charge.