Lunatone

DALI-2 CS Integration

DALI-2 CS THP

DALI-2 CS THP-AQ

Datasheet

Combi Sensor Modul for Integration

DALI-2 sensor module for
measurement of:

motion
light intensity
temperature (T)
relative humidity (H)
air pressure (P)

additional for DALI-2 CS THP-AQ
air quality (AQ)

Art. Nr. 86457786-INT
Art. Nr. 86457786-INT-AQ

Detection range variants: -15, -O
Colour variants: -W16, -B
Installation type variants: -ZD,-AP,-LE

DALI-2 Combi Sensor Integration

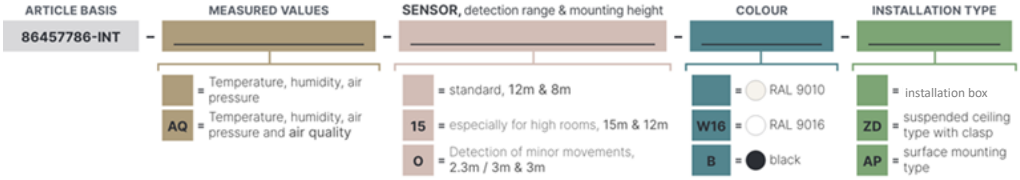
Multifunctional Sensor Modul for Integration

Overview

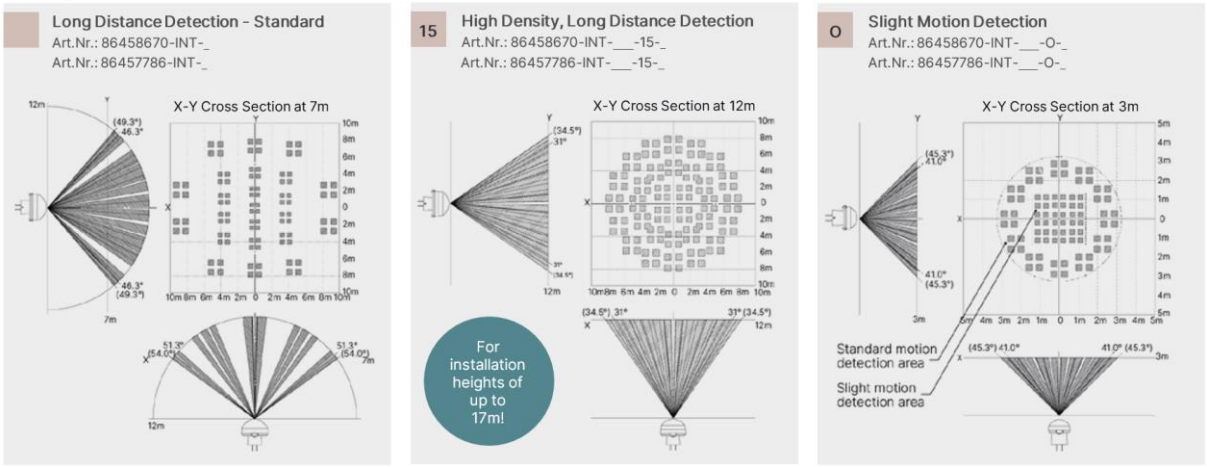
- Sensor module for Integration in systems with a central control or in combination with a DALI-2 CS Master (Art. Nr. 86458670) – www.lunatone.com/en/product/dali-2-cs/
- **DALI-2 CS THP Integration** (Art. Nr.: 86457786-INT) sensor module for measuring movement, light intensity, temperature (**T**), relative humidity (**H**), and air pressure (**P**)
- **DALI-2 CS THP-AQ Integration** (Art. Nr.: 86457786-INT-AQ) sensor module for measuring movement, light intensity, temperature (**T**), relative humidity (**H**), air pressure (**P**) and air quality (**AQ**)
- Easy configuration via DALI-Cockpit Software Tool and Lunatone DALI USB interface.
- Several sensor modules can be installed within a DALI system.
- Supply via the DALI bus, no additional power supply needed.
- Doubled terminals for easy installation
- DALI -2 Instance types
  motion detection (PIR), instance type 3 (62386-303)
  light intensity measurement, instance type 4 (62386-304)
  temperature measurement, instance type 0 (62386-103)
  relative humidity measurement, instance type 0 (62386-103)
  air pressure measurement, instance type 0 (62386-103)
  air quality measurement, instance type 0 (62386-103)
  eCO2 measurement, instance type 0 (62386-103)
- Optimized variants for different applications and detection areas (hall, office) available
- Version for integration in luminaires available (Art. Nr. 86457786-INT-LE, Art. Nr. 86457786-INT-AQ-LE)
- Version DALI-2 CS Integration, motion and light https://www.lunatone.com/en/product/dali-2-cs-integration/
- Version DALI-2 CS motion and light https://www.lunatone.com/en/product/dali-2-cs/

Specification, Characteristics

DALI-2 CS THP Integration: measurement of motion, light intensity, temperature, humidity, air pressure and optional air quality (version -AQ)



Lens types:



Installation types:

type	**DALI-2 CS THP and DALI-2 CS THP-AQ**		
application	standard	hall	office
article number	86457786-INT 86457786-INT-AQ	86457786-INT-15 86457786-INT-AQ-15	86457786-INT-O 86457786-INT-AQ-O

electrical data	
supply	via DALI signal line (DALI-voltage according IEC62386)
marking terminals	DA, DA
current consumption DALI 16.5V	1.7 mA
current consumption DALI 22.5V	2.2 mA
power consumption	<100mW
control	DALI-2

insulation data	
impulse voltage category	II

pollution degree	2
rated insulation voltage	250V
rated impulse withstanding voltage	4kV
insulation DALI/housing	reinforced isolation
insulation test voltage	3000Vac

environmental conditions

storing and transportation temperature	-20°C … +70°C		
operational ambient temperature	-20°C … +60°C	-20°C … +55°C	-20°C … +60°C
rel. humidity, none condensing	15% … 90%		

technical data

Motion Detection (62386 -303)			
principle	PIR	PIR	PIR
detection range (at >8°C temperature difference)	12m	15m	3m /2.3m
typical mounting height	8m	12m	3m
zones	92	128	36 / 48
horizontal	±51°	±34,5°	±44°/±90°
vertical	±46°	±34,5°	±44°/±90°
min. temperature difference	>4°C	>4°C	>4°C
details	Figure. 1, page 8	Figure. 2, page 9	Figure. 3, page 9
light sensor (62386-304)	range: 0-2046lux (11bit), resolution: 1lux events: 0-2046lux(10bit), resolution: 2lux		
temperature sensor (62386-103)	range: -20°C ... 80°C, resolution: 0,1°C		
humidity sensor (62386-103)	range: 0% ... 100%, resolution: 0,1%		
Air pressure sensor (62386-103)	range:600hPa ... 1100hPa, resolution: 1hPa		

air quality sensor (62386-103)

only for **CS THP-AQ**
range: 0 ... 500, resolution: 1

index	air quality	index	air quality
0 - 50	excellent	201 – 250	heavily polluted
51- 100	good	251 -350	severely polluted
101 - 150	lightly polluted	> 351	extremely polluted
151 - 200	moderately polluted		

eCO2 sensor (CO2 equivalent) (62386-103)

for **CS THP-AQ**
range: 0ppm ... 8000ppm, resolution: 10ppm

ppm	air quality	ppm	air quality
0 - 350	excellent	1501 -2500	heavily polluted
351- 700	good	2501-5000	severely polluted
701 - 1000	lightly polluted	5001-8000	extremely polluted
1001 – 1500	moderately polluted		

general data

protection class	II in intended use
protection degree	IP20
mounting	back box – dimensions see below surface mounted (article number extension „-AP“) – dimensions below suspended ceiling (article number extension „-ZD“) – dimensions below
available colours	RAL9010 RAL9016 (article number extension “–W16“) Black (article number extension “–B”)

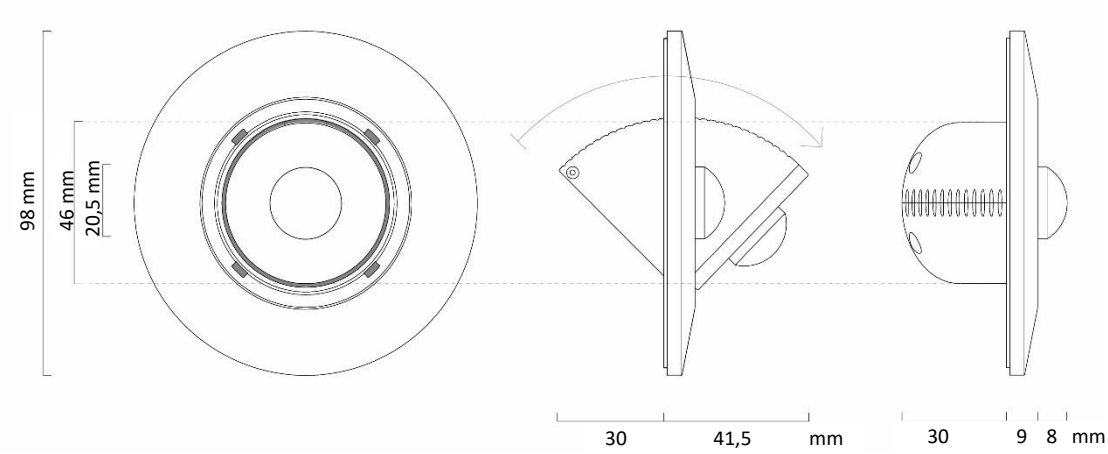
DALI-2 functionality	Integration – instance mode

terminals

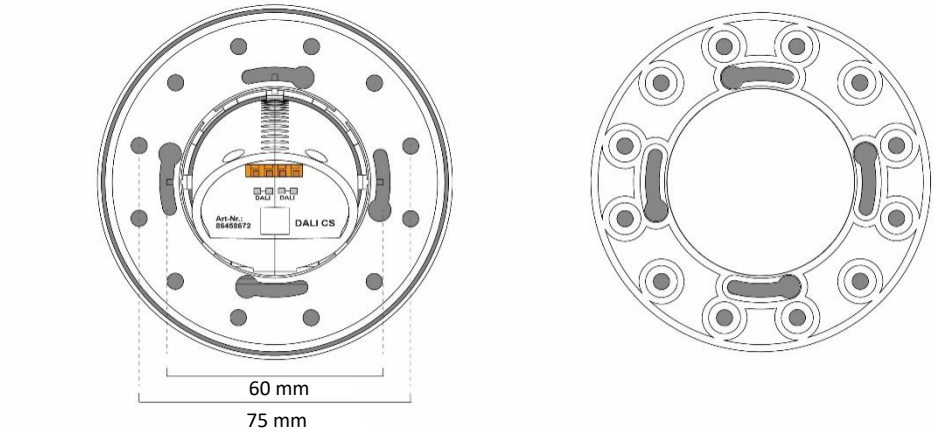
connection type	spring terminal connector
wire size solid core	0,5 … 1,5 mm² (AWG20 … AWG16)
wire size fine wired	0,5 … 1,5 mm² (AWG20 … AWG16)
wire size using wire end ferrule	0,25 … 1,5 mm²
stripping length	8,5 … 9,5 mm / 0,33 … 0,37 inch

standards

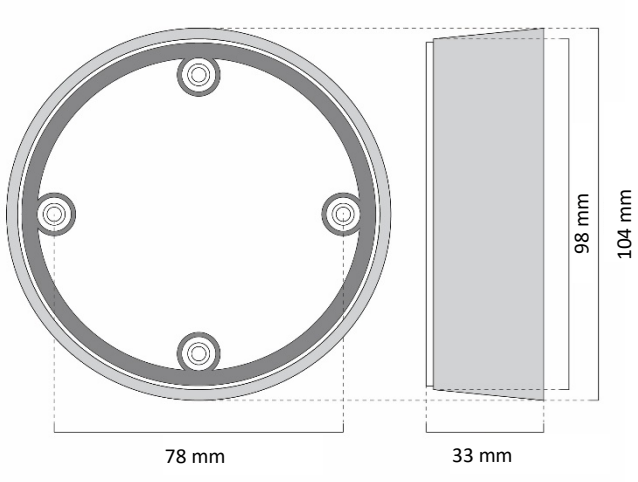
EMC	EN 61547 EN 55015
safety	EN 61347-2-11 EN 61347-1
markings	DALI-2, CE



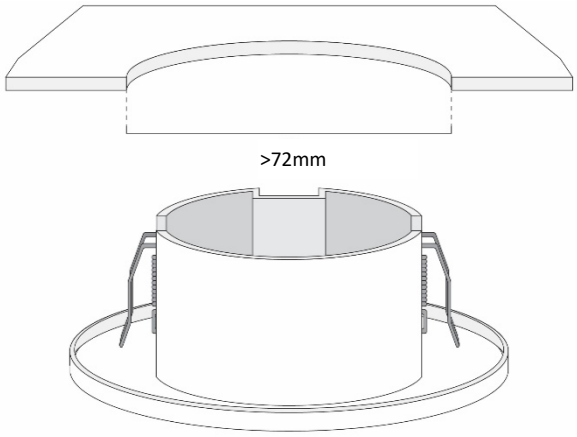
dimensions and space requirements



dimensions mounting ring



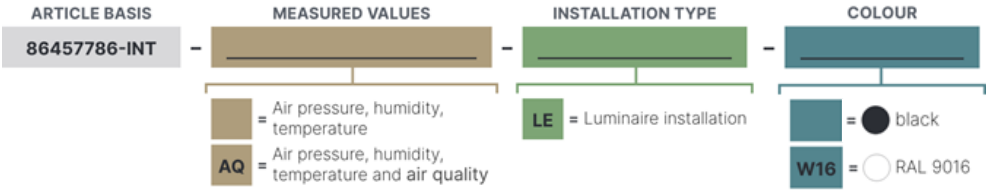
surface mounting
dimensions accessory
article number addition „-AP“



suspended ceiling
dimensions mounting hole diameter
article number addition „-ZD“

Specification, Characteristics - Version Luminaire installation

DALI-2 CS THP Integration – for installation in luminaires: measurement of motion, light intensity, temperature, humidity, air pressure and optional air quality (-AQ)



type	**DALI-2 CS THP Luminaire installation** **DALI-2 CS THP-AQ Luminaire installation**
article number	86457786-INT-LE 86457786-INT-AQ-LE

electrical data	
supply	via DALI signal line (DALI-voltage according IEC62386)
marking terminals	-
current consumption DALI 16.5V	1.7 mA
current consumption DALI 22.5V	2.2 mA
power consumption	<100mW
control	DALI-2

insulation data	
impulse voltage category	II
pollution degree	2
rated insulation voltage	250V
rated impulse withstanding voltage	4kV
insulation DALI/housing	reinforced isolation
insulation test voltage	3000Vac

environmental conditions

storing and transportation temperature	-20°C … +70°C
operational ambient temperature	-20°C … +60°C
rel. humidity, none condensing	15% … 90%

technical data

Motion Detection (62386 -303)	
principle	PIR
detection range (at >8°C temperature difference)	7m
typical mounting height	3m
zones	32
horizontal	±45°
vertical	±45°
min. temperature difference	>4°C
details	Figure. 4, page 10
light sensor (62386-304)	range: 0-2046lux (11bit), resolution: 1lux event: 0-2046lux(10bit), resolution: 2lux
temperature sensor (62386-103)	range: -20°C ... 80°C, resolution: 0,1°C
humidity sensor (62386-302)	range: 0% ... 100%, resolution: 0,1%
Air pressure sensor (62386-103)	range: 600hPa … 1100hPa, resolution: 1hPa
air quality sensor (62386-103)	only for CS THP-**AQ**-LE range: 0 ... 500, resolution: 1

index	air quality	index	air quality
0 - 50	Excellent	201 – 250	heavily polluted
51- 100	Good	251 -350	severely polluted
101 - 150	lightly polluted	> 351	extremely polluted
151 - 200	moderately polluted		

eCO2 sensor (CO2 equivalent) (62386-103)	only for CS THP-**AQ**-LE range: 0ppm ... 8000ppm, resolution: 10ppm

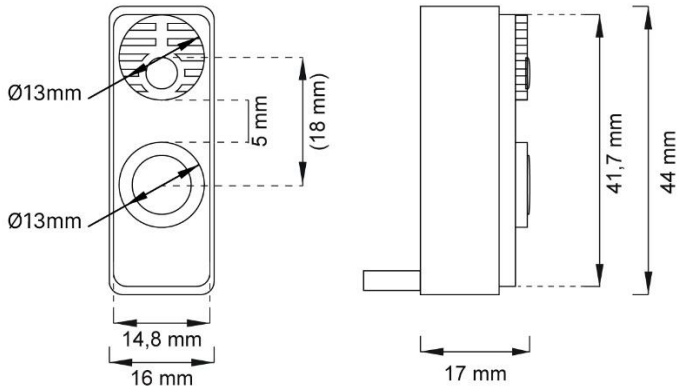
ppm	air quality	ppm	air quality
0 - 350	excellent	1501 -2500	heavily polluted
351- 700	good	2501-5000	severely polluted
701 - 1000	lightly polluted	5001-8000	extremely polluted
1001 – 1500	moderately polluted		

general data

protection class	II in intended use
protection degree	IP20
mounting	Luminaire installation – dimensions see below
available colours	black RAL9016 (article number extension “–W16“)
DALI-2 functionality	integration – instance mode

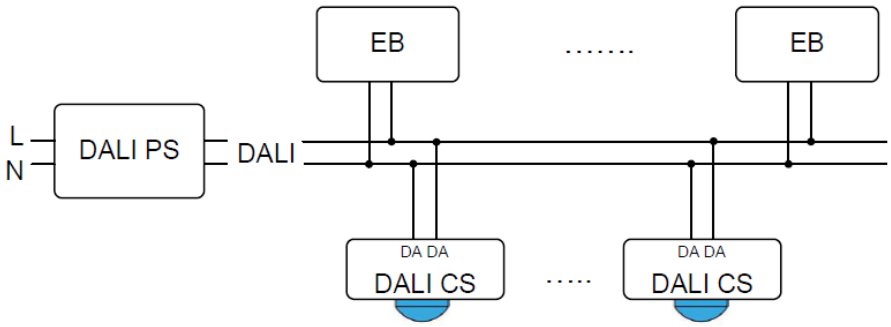
standards

EMC	EN 61547 EN 55015
safety	EN 61347-2-11 EN 61347-1
markings	DALI-2, CE



dimensions and space requirements – luminaire installation- article number extension „-LE“

Application example



typical application: several sensors on one DALI-line

Sensor types

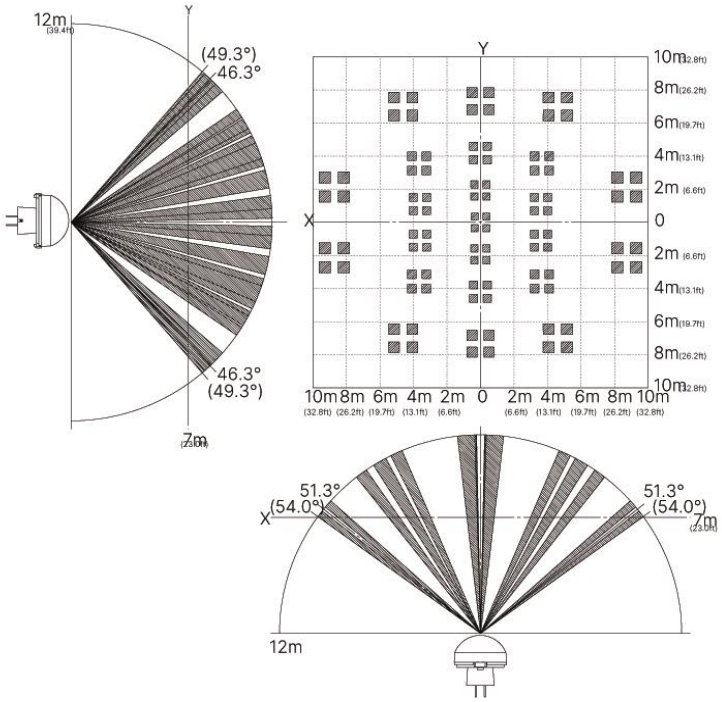


Figure. 1 ***CS: Standard*** *motion detection (Art. Nr.: 86457786-INT, Art. Nr.: 86457786-INT-AQ) detection area:* ***X-Y cross section at 7m***

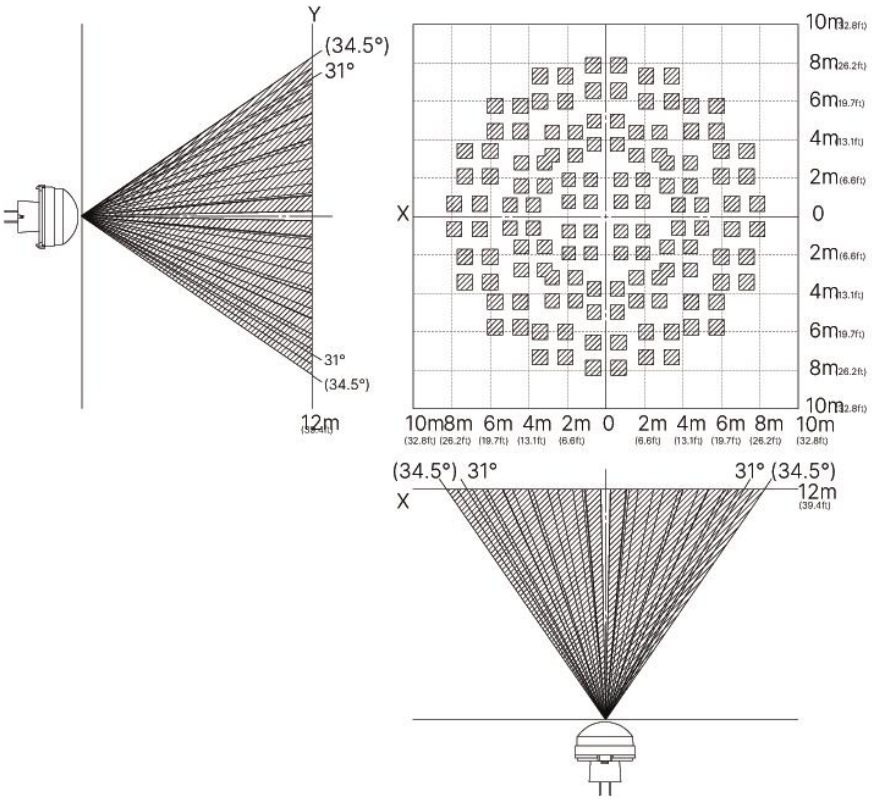


Figure. 2 ***CS-15: Hall*** *motion detection (Art. Nr.: 86457786-INT-**15,***
*Art. Nr.: 86457786-INT-AQ-**15**) detection area* ***X-Y cross section at* 12m** *- High density, long distance detection type*

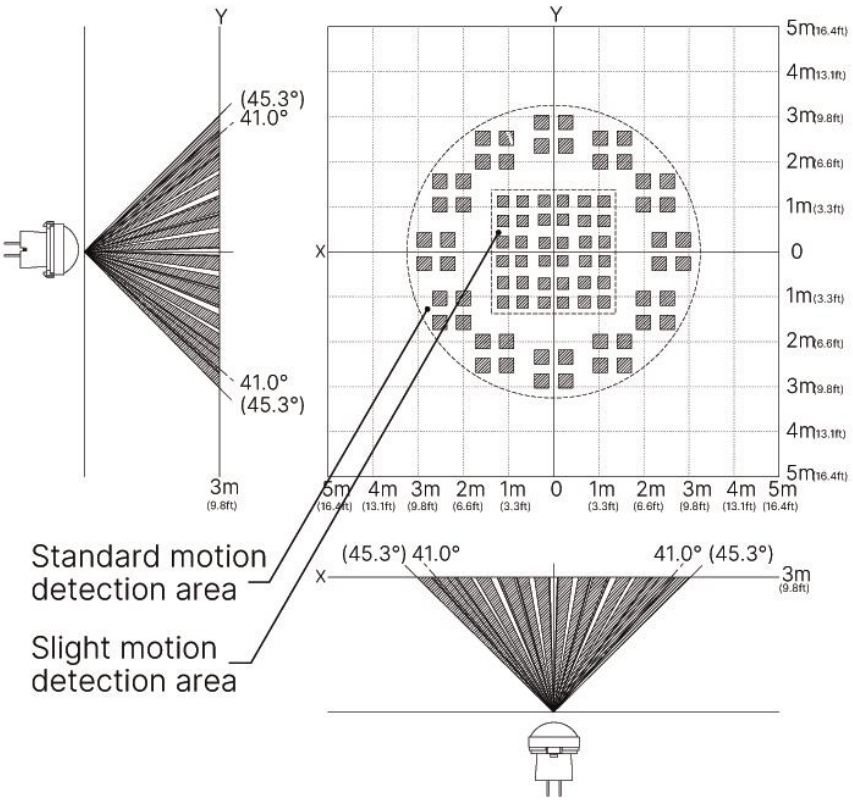


Figure. 3 ***CS-O: Office*** *motion detection (Art. Nr.: 86457786-INT-**O**, Art. Nr.: 86457786-INT-AQ-**O**) Detection area:* ***X-Y cross section at 3m*** *- The rectangular centre zone is optimized for detecting smallest movements.*

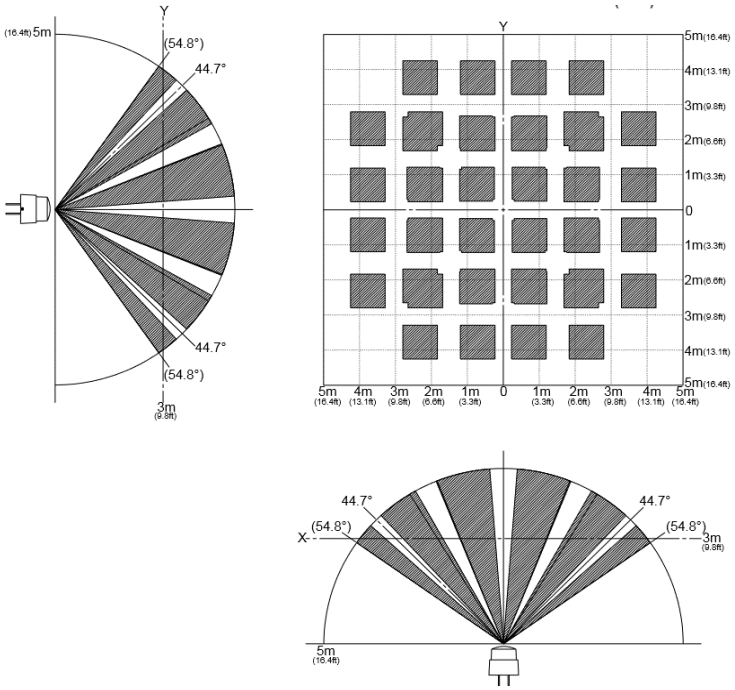


Figure. 4 ***CS-LE: luminaire installation:*** *motion detection (Art. Nr.: 86457786-INT-**LE,** Art. Nr.: 86457786-INT-AQ-**LE**) detection area:* ***X-Y cross section at 3m****.*

Factory Setting

For combination with the DALI-2 CS as Master the factory settings are sufficient. The device configuration can be changed via the DALI Cockpit and adapted to the current application.

Front-LED (motion indication)	inactive
Behaviour on DALI Reset command	reset to delivery default settings
Event Nachrichten:	
Motion	inactive
Light	inactive
Temperature	inactive
Humidity	inactive
Air pressure	inactive
Air quality	inactive
eCO2	inactive

The following instance settings are the delivery default and are necessary in combination with a DALI-2 CS Master. In combination with a central control unit, the specifications of the central control unit need to be followed (especially with regard to the event schema).

Instance No. 0 – Motion:

Event messages	inactive
Event Schema	device addressing
Event Filter	Occupied Vacant
Deat time	0.00 sec
Report time	not applicable
Hold time	1 sec

Instance No. 1– light:

Event messages	inactive
Event Schema	device addressing
Event Filter	illuminance level
Deat time	0.8 sec
Report time	unused
Hysteresis Min	5 Lux
Hysteresis	5 %

Instance No. 2 – Temperature
Instance No. 3 – Luftfeutchtigkeit
Instance No. 4 – Luftdruck
Instance No. 5 – Luftqualität
Instance No. 6 – eCO2:

Event messages	inactive
Event Schema	Instance addressing
Event Filter	sensor value
Deat time	1.5 sec
Report time	unused
Hysteresis Min	2 (°C/%/hPa/)
Event messages	5 %

For general information on DALI instances see also the "DALI-2 Instance guide".

Installation

- the DALI-2 CS is directly connected and supplied by the DALI bus. A general DALI bus power supply is required
- The connection to the DALI terminals can be made regardless of polarity.
- The terminals are suitable for wire cross-sections ranging from 0.5 mm^2 to 1.5 mm^2.
- back box mounting: installation of the mounting ring directly on the back box. The housing is then simply plugged onto to the mounting ring. The recessed head has sufficient space within the electrical installation box enabling a completely flat installation.
- The CS Module enables alignment to the desired detection area through 360 ° axial rotation and vertical inclination of up to 40°.
- For mounting the sensor on cavity walls or suspended ceilings a version including additional fixtures with spring-clips is available: article number extension “-ZD”.
- Version for surface mounting is available: article number extension “-AP”.
- Version integration in luminaires is available (Art.Nr.: 86457786-INT-LE, Art.Nr.: 86457786-INT-AQ-LE)
- The wiring should be carried out as a permanent installation in a dry and clean environment.
- Installation may only be carried out in a voltage-free state of the system and by qualified specialists.
- National regulations for setting up electrical systems must be followed.
- The DALI wiring can be realized with standard low-voltage installation material. No special cables are required.

- Only 1 wire may be connected to each terminal. When using double wire end ferrules, the connection capacity of the terminal must be considered.

Attention: The DALI-signal is not classified as SELV circuit (Safety Extra Low Voltage). Therefore, the installation regulations for low voltage apply.

Note: The cross section: the voltage drop on the DALI line must not exceed 2V at maximum length (300m) and maximum bus load (250mA).

Presence Detection

For movement detection a temperature difference between the moving object and environment of at least 4°C is required. Heat sources such as copiers or heaters may have a negative influence on motion detection.

Presence Detection (Standard)

The applied PIR method allows coverage of relatively large areas using only one sensor head. With opening angles of 92° and 102° and a sensor mounted at a height of 5 meters the 92 detection zones cover an area of more than 100m^2. The distance between sensor and the object of interest should be less than 12 meters, which limits the mounting height to about 8m. See Figure. 1, page 8 und table 1 below.

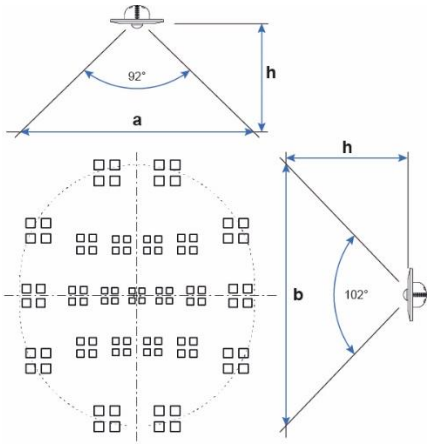


table. 1 CS-Standard: relation of mounting height and detection area

h [m]	a [m]	b [m]	A [m2]
2,50	5,2	6,2	25,1
2,7	5,6	6,7	29,3
3,0	6,2	7,4	36,2
3,5	7,2	8,6	49,2
4,0	8,3	9,9	64,3
5,0	10,4	12,3	100,4
6,0	12,4	14,8	144,6
8,0	16,6	19,8	257,1

Presence Detection CS-15

The sensor type „-15“ is suitable for high rooms (e.g. halls) with mounting height up to 12m. The detection range is about 15m
See Figure. 2, page 9 and table 2 below.

table. 2 CS- hall (15): relation of mounting height and detection area

h [m]	a [m]	b [m]	A [m2]
5,0	6,9	6,9	37,1
7,5	10,3	10,3	83,5
10,0	13,7	13,7	148,4
12,0	16,5	16,5	213,7

Presence Detection CS-O

Suitable for office application where detection of slight motion is required e.g. detection of arm movement of a sitting person. The DALI CS-O is tailored to this application and has a sensitive “inner area” and a standard detection “outer area”. The maximum mounting height is about 3m. See Figure. 3, page 9.

The rectangular central zone is optimized for detection of the slightest motion. The area has an opening angle of 44 ° x 44 ° and 36 detection zones. With a mounting height of e.g. 2.2m, an area of 3.24 m^2 can be covered, see Figure. 5 and table 3.

The outer standard motion detection zone has an opening angle of 90 ° x 90 ° and 48 detection zones. With a mounting height of e.g. 2.2m, an area of 15.2m2 can be covered. (see table 3).

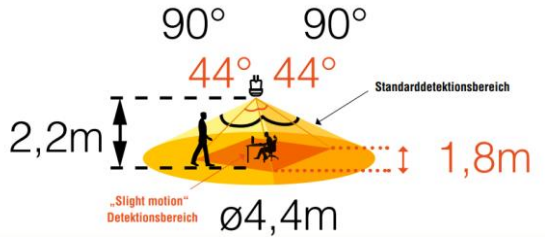


Figure. 5 CS-Office detection range

table. 3 CS-Office: relation of mounting height and detection area

	Standard Detection area			Slight motion detection area	
h [m]	a [m]	b [m]	A1 [m²]	l [m]	A2 [m²]
2,0	4	4	12,5	1,6	2,56
2,2	4,4	4,4	15,2	1,8	3,24
2,5	5	5	19,6	2	4
3,0	6	6	28,2	2,4	5,76

The recommended mounting height is 3m. The distance between the sensor and the object to detect should not be greater than 3.1m.

Presence Detection CS-LE

Der DALI-2 CS-LE has a PIR lens with opening angles of 110°x 110° und 32 detection zones. With a typical mounting height of 3m, over 25m2 of surface can be covered, see Figure. 4 , page 10. The distance between the sensor and the object to be detected should be a maximum of 5m.

Light Sensor

Light measurement

All DALI-2 CS versions also include a light sensor. The light sensor measures the reflected illuminance in a range from 0 to 2047 lux. The resolution is 2 lux.

The incident light is rated by the spectral sensitivity of the human eye and thus comparable to the subjective visual perception of brightness.

The incident light is accumulated over the area covered by the lens and can be interpreted as average value in the detection area. A reference to the reflecting surface below the sensor can be established with the help of a reference measurement and adjustable offset value.

Functionality

The *DALI-2 CS Integration* is for use in systems with higher-level controls, such as for example DALI-2 CS, WAGO, Beckhoff, etc.. The measured values can either be queried or they can automatically trigger events. This functionality is implemented via DALI-2 instances.

Different versions with different sensors are available: The DALI-2 CS THP (Art. Nr.: 86457786-INT) can measure motion, light, temperature, humidity and air pressure. The DALI-2 CS THP-AQ (Art. Nr.: 86457786-INT-AQ) measures all previously listed values as well as air quality. For Version with sole motion and light detection see DALI-2 CS Integration (Art. Nr.: 86458670-INT).

For each detectable sensor value a separate DALI-2 instance is implemented in the device. All instances are DALI-2 certified and comply with the DALI-2 standard.

The measured sensor instance values can either be queried via a “Query” command or sent as a DALI-2 event message.

Each instance can be activated or deactivated (independent of the other instances).

It is possible to assign all instances to one or several instance groups.

Die Eventpriorität ist für jede Instanz einzeln einstellbar, ebenso der Eventfilter, Deadtime und Reporttime.

The event priority can be set individually for each instance, as can the event filter, dead-time and report-time.

For general information on DALI instances see also the "DALI-2 Instance guide".

Instances: General

Each instance can be configured individually. Some settings have the same functionality for all sensor instances and are therefore described in this section. Instance specific settings are explained for each individual instances in the following respective sections.

enable/disable
If instances are not required, they can be deactivated. In this case, event messages are not sent, and the measured values are not updated. They can, however, still be queried via a “Query” command, and the DALI-2 configuration commands and queries are still supported.

Instance group
Up to three instance groups can be assigned for each instance. Only the "Primary Group" is used for the event.

Instance type
The instance type defines which DALI-2 standard is valid for this instance. (The different instance types are specified in the DALI-2 standard.)

Instance number
Each instance in a device has a unique instance number.

Device group
The device can be assigned to up to 32 device groups (0...31). The lowest device group is used for the event.

Device address
A device address (or short address) (0..63) can be assigned to each device. With this the device can be clearly addressed. (Identical short addresses should be avoided.)

Event Scheme
The event scheme determines which information is transferred with the event. This information is required, to enable recognition and / filtering of events on the bus. The following 5 options are available:

- Instance addressing:
  instance type and instance number
- Device Addressing:
  device address and instance type
- Device/Instance Addressing:
  device address and instance number
- Device Group Addressing:
  Device group and instance type
- Instance Group Addressing:
  Instance group and instance type

Event priority
The event priority determines the order in which events are sent when they occur simultaneously on the bus. Priority 2 = highest and 5 = lowest.

Dead Time
The dead time can be set for each instance. It determines the time that must pass before an

event can be sent again. This also applies if the event information (measured value) changes. If no dead time is required, it can be deactivated.

Report Time
If the event information does not change, the event is sent cyclically with the report time. The report time can be set for each instance. It determines the maximum time between a sent event and resending.

Hysteresis
Not every change in value leads to an event being generated. The hysteresis can be used to set which percentage change is necessary to trigger a new transmission. Attention, the hysteresis band is not arranged symmetrically. The following applies:
Increasing value:
The condition for an event is only fulfilled if the next value falls below the previous value minus the hysteresis or if the next value is greater than the previous value.
Decreasing value:
the condition for an event is only fulfilled if the next value exceeds the previous value plus the hysteresis or the next value is smaller than the previous value.

Hysteresis Min
Is the minimal hysteresis value that cannot be fallen below of.

Instance 0: Motion

Is an instance standardized by DALI-2 for motion detection (62386-303). All settings are implemented according to the standard. The instance is DALI-2 certified.

The sensor switches between the following states:

- People in the room and movement (0xFF)
- People in the room and no movement (0xAA)
- Empty room (0x00)

If the sensor detects movement, it immediately changes to the state: "people in the room and movement". This state is exited after 1 second at the earliest if no further movement is detected. In this case it changes to the state "People in the room and no movement". After the hold time has expired it changes to the state "Empty room".

Hold Time: Is the time that must pass before the state "people in the room and no movement" is changed to the state "empty room". If movement is detected during this time the state is changed back to: "People in the room and movement".

Query: The current sensor state can be queried using the DALI command "Query input value". The following values are possible: 0x00, 0xAA, 0xFF
(see paragraph above for the possible states)

Event: the sensor status is transmitted by events. The following event information is available:
Bit0 = 0: No Movement
Bit0 = 1: Movement
Bit2/Bit1 = 00: Vacant
Bit2/Bit1 = 10: Still Vacant
Bit2/Bit1 = 01: Occupied
Bit2/Bit1 = 11: Still Occupied
Bit3 = 1: Movement Sensor
Bit5..Bit9 = 0: unused
More details can be found in the standard 62386-303.

Event filter: The event filter defines for which status change an event is generated.
Filter arrangement:
Bit0: Occupied Event active
Bit1: Vacant Event active

Bit2: Still Vacant/Occupied Event active
Bit3: Movement Event active
Bit4: No Movement Event active
Bit5..Bit7: unused

Example events during the movement sequence:

1: Movement detected:
Event filter "Movement", event filter "Occupied":
→ Event data: 0x0B
2: Continued movement: with set report time, event filter "Still Occupied/Vacant": → Event data: 0x0F
3: Movement stops: event filter "No Movement":
→Event data: 0x0A
4. Expiry of set hold time:
Event filter "Vacant":→ Event data: 0x08
5. Still no movement: with set report time: event filter "Still Occupied/Vacant"
→ Event data 0x0C

Instance 1: Light intensity

is an instance standardized by DALI-2 (62386-304). All settings are implemented according to the standard. The instance is DALI-2 certified.

The current light value (lux) is measured by the sensor and can either be queried using a "Query" command or can be automatically provided by the sensor using an event.

The measuring range is 0Lux ... 2046Lux. The resolution differs between queries and generated events. A query supports a resolution of 1Lux (11Bit) and an event a resolution of 2Lux (10Bit). This means that the values obtained from an event must be multiplied by 2 to determine the light level in lux.

Query: the light level can be queried using the commands "Query input value" and "Query Input value latch". 11 bits are taken from the returned data, which correspond to the light level in lux:
Query Input Value → answer: 0x6C
Query Input Value Latch → answer: 0x9B

0x6C = **0110 1100**
0x9B = **100**1 1011
→ **0110 1100 100** = 868 Lux

Hysteresis: see chapter "*Instances General" – "Hysteresis"* page 15.

Hysteresis Min: set in lux. For general information see chapter "*Instances General*" - "*Hysteresis Min"* page 15.

Event Filter: if the filter is deactivated, no events will be sent.

Instance 2: Temperature

is an instance standardized by DALI-2 (62386-103), instance type 0, generic. All settings are implemented according to the standard. The instance is DALI-2 certified.

The current air temperature (°C) is measured by the sensor and can either be queried using a "Query" command or can be automatically provided by the sensor using an event. The measuring range is -20°C ... 80°C. The sensor measurement accuracy is +/-1°C. The resolution for both query and event is 0.1°C (10Bit). The value 0dec corresponds to -20°C and the value 1000dec corresponds to 80°C.
Note: After a device start up the sensor values are only valid after approx. 5-10 minutes.

Hysteresis: see chapter "*Instances General" – "Hysteresis"* page 15.

Hysteresis Min: set in °C. For general information see chapter "*Instances General*" - "*Hysteresis Min"* page 15.

Event Filter: if the filter is deactivated, no events will be sent.

Instance 3: Humidity

is an instance standardized by DALI-2 (62386-103), instance type 0, generic. All settings are implemented according to the standard. The instance is DALI-2 certified.

The current relative humidity (%) is measured by the sensor and can either be queried using a “Query” command or can be automatically provided by the sensor using an event. The measuring range is 0% ... 100%. The sensor measurement accuracy is +/-3%. The resolution for both query and event is 0.1% (10Bit). The value 0dec corresponds to 0% and the value 1000dec corresponds to 100%.
Note: After a device start up the sensor values are only valid after approx. 5-10 minutes.

Query: see example page 21

Hysteresis: see chapter "*Instances General”* – “*Hysteresis”* page 15.

Hysteresis Min: set in %. For general information see chapter "*Instances General*" - “*Hysteresis Min”* page 15.

Event Filter: if the filter is deactivated, no events will be sent.

Instance 4: air pressure

is an instance standardized by DALI-2 (62386-103), instance type 0, generic. All settings are implemented according to the standard. The instance is DALI-2 certified.

The current air pressure (hPa) is measured by the sensor and can either be queried using a “Query” command or can be automatically provided by the sensor using an event. The measuring range is 600hPa ... 1100hPa. The sensor measurement accuracy is +/-0.6hPa.
Note: After a device start up the sensor values are only valid after approx. 5-10 minutes.

The resolution for both query and event is 1hPa (10Bit). The value 0dec corresponds to 600hPa and the value 800dec corresponds to 1100hPa.

Query: see example page 21

Hysteresis: see chapter "*Instances General”* – “*Hysteresis”* page 15.

Hysteresis Min: set in hPa. For general information see chapter "*Instances General*" - “*Hysteresis Min”* page 15.

Event Filter: if the filter is deactivated, no events will be sent.

Instance 5: air quality

For Version: CS THP-AQ

is an instance standardized by DALI-2 (62386-103), instance type 0, generic. All settings are implemented according to the standard. The instance is DALI-2 certified.

The sensor measures the air quality based on the proportion of existing air pollution. The air quality is shown as an index, ranging from 0 ... 500. The sensor measurement accuracy is +/-15%. The following table describes the relationship between the index and air quality:

Index	Air quality	
0-50	Excellent	
51-100	Good	
101-150	Lightly polluted	
151-200	Moderately polluted	
201-250	Heavily polluted	
251-350	Severely polluted	
>351	Extremely polluted	

Table 4 on page 16 describes the possible impact and suggested counter measures in case of poor air quality. **Note:** After a device start up the sensor values are only valid after approx. 5-10 minutes.

Query: see example page 21

Hysteresis: see chapter "*Instances General" – "Hysteresis"* page 15.

Hysteresis Min: set as index. For general information see chapter "*Instances General*" - "*Hysteresis Min"* page 15.

Event Filter: if the filter is deactivated, no events will be sent.

Instance 6: eCO2 – CO2 equivalent

Version: CS THP-AQ

is an instance standardized by DALI-2 (62386-103), instance type 0, generic. All settings are implemented according to the standard. The instance is DALI-2 certified.

The sensor measures the air quality based on the proportion of existing air pollution. From the measured value the CO2 equivalent can be calculated: eCO2 value, ranging from 0ppm ... 8000ppm. The sensor measurement accuracy is +/-15%. The following table describes the relationship between the eCO2 value and air quality.

eCO2 (ppm)	air quality
0 - 350	Excellent
351- 700	Good
701 - 1000	Lightly polluted
1001 – 1500	Moderately polluted
1501-2500	Heavily polluted
2501-5000	Severely polluted
5001-8000	Extremely polluted

Table 4 on page 17 describes the possible impact and suggested counter measures in case of poor air quality. **Note:** After a device start up the sensor values are only valid after approx. 5-10 minutes.

Query: see example page 21

Hysteresis: see chapter "*Instances General" – "Hysteresis"* page 15.

Hysteresis Min: set as index. For general information see chapter "*Instances General*" - "*Hysteresis Min"* page 15.

Event Filter: if the filter is deactivated, no events will be sent.

Table 4 impact and suggested action for different air quality index

	Index	eCO2 (ppm)	Impact (long-term exposure)	Suggested action
	0-50	0 - 350	Pure air; best for well-being	No measures needed
	51-100	351- 700	No irritation or impact on well-being	No measures needed
	101-150	701 - 1000	Reduction of well-being possible	Ventilation suggested
	151-200	1001 – 1500	More significant irritation possible	Increase ventilation with clean air
	201-250	1501-2500	Exposition might lead to effects like headache depending on type of pollution	optimize ventilation
	251-350	2501-5000	More severe health issue possible if harmful substances are present	Contamination should be identified if level is reached even w/o presence of people; maximize ventilation & reduce attendance
	>351	5001-8000	Headaches, additional neurotoxic effects possible	Contamination needs to be identified; avoid presence in room and maximize ventilation

Configuration in the DALI-Cockpit

The DALI CS can be addressed and configured using the DALI-Cockpit PC software tool and a suitable interface to the DALI bus (e.g. DALI USB, DALI SCI RS232 or DALI4Net).

After the device has been addressed, the parameters can be adjusted to the user application.

The localisation of the sensor can be carried out by visual means. To do this, the checkbox: "localize" must be selected in the DALI cockpit in order to make the red LED integrated in the sensor flash.

The settings are distributed on different tabs:

tab: „General“
see Figure. 6, page 20
The basic configuration can be made on the "General" tab.

Behaviour on DALI Reset
The behaviour in response to a DALI reset command is configurable. The following options are available:

- *Ignore command*: The DALI reset command does not trigger any changes to the device settings.
- *DALI Standard*: DALI-2 instance settings are set to the values defined in the DALI standard. The settings for the Application Controller remain unchanged.
- *Factory settings*: The sensor settings are reset to the Lunatone factory default settings – see the table in the section "Factory Setting" section, page 10.

tab: „Instances“
See Figure. 7, page 20
Depending on the version up to 6 instances are available:

DALI-2 CS THP:

- Instance 0, motion detection
- Instance 1, light intensity
- Instance 2, temperature
- Instance 3, humidity
- Instance 4, air pressure

DALI-2 CS THP-AQ

- Instance 0, motion detection
- Instance 1, light intensity
- Instance 2, temperature
- Instance 3, humidity
- Instance 4, air pressure
- Instance 5, air quality
- Instance 6, eCO2

tab: „Overview“
see Figure. 8, page 21
The overview shows which instances are activated / deactivated and enables periodic queries of the currently measured values.

In order to adjust the measured values, it is possible to set an offset value for temperature and relative humidity.

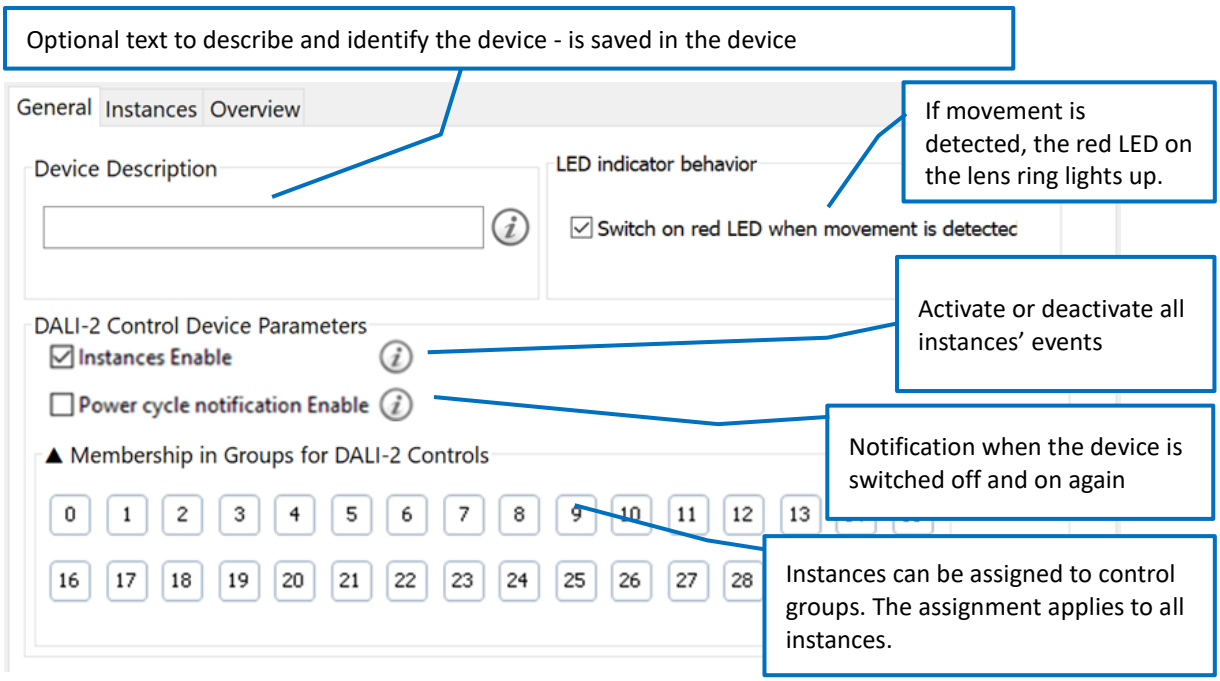


Figure. 6 Cockpit tab General - general settings

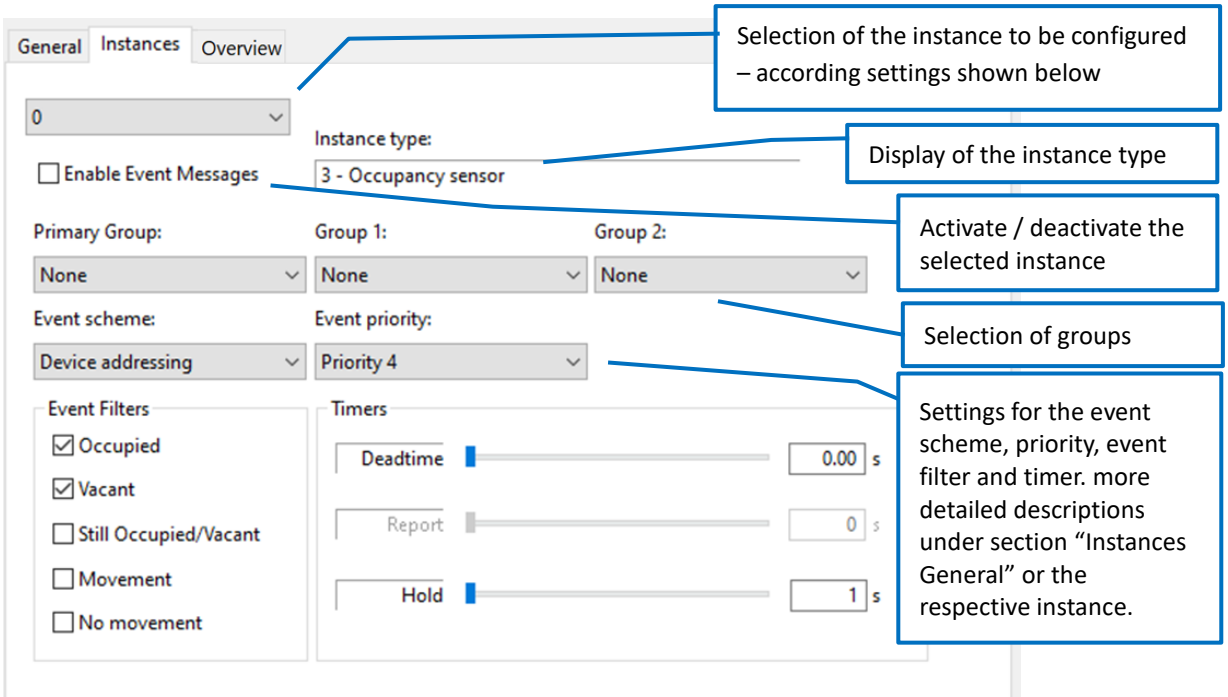


Figure. 7 Cockpit tab Instances - settings for each instance

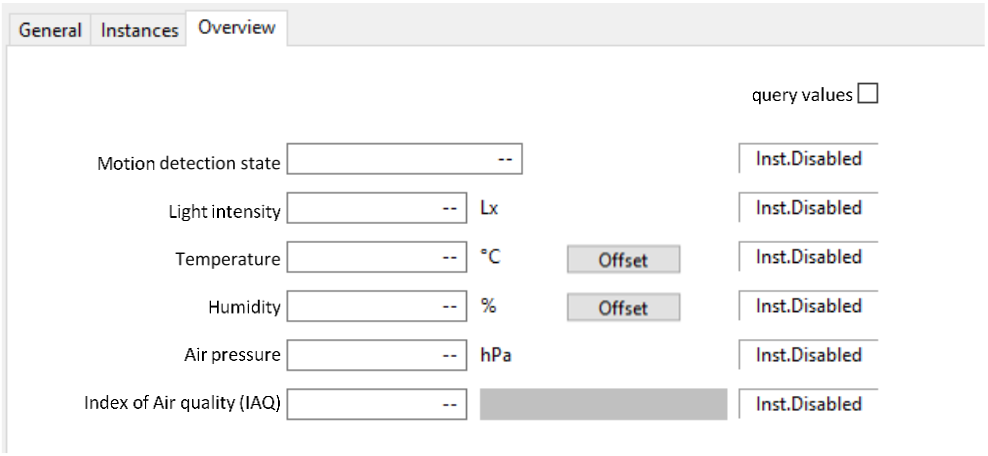


Figure. 8 Cockpit tab Overview - read and display the measured sensor values

Example Query Sensor Values – generic Instances

Table 5 Summary of the returned info by generic sensor instances for value calculation

	Temperature		Humidity		Pressure		AirQuality		eCO2	
	hex	**dez**	**hex**	**dez**	**hex**	**dez**	**hex**	**dez**	**hex**	**dez**
Value Multiplicator	01	1	01	1	01	1	01	1	08	8
Value Divisor	0A	10	0A	10	02	2	01	1	01	1
Offset	62E3	25315	0000	0	0258	600	0000	0	0000	0
Offset Multiplicator	01	1	01	1	01	1	01	1	01	1
Offset Divisor	64	100	01	1	01	1	01	1	01	1
Unit	00	0 (=Kelvin)	0C	12 (=%)	0F	15 (=hPa)	10	16 (=1)	01	1 (=ppm)
Resolution	10bit		10bit		10bit		9bit		10bit	

$$Value[unit] = Input\,Value \cdot \frac{ValueMultiplicator}{ValueDivisor} + Offset \cdot \frac{OffsetMultiplicator}{OffsetDivisor}$$

The following examples show the evaluation of sensor values of the generic Lunatone instances based on the temperature instance. The same procedure also applies to air pressure, air quality, CO2 equivalent and humidity. For a technical description of all supported commands of the generic Lunatone instances see the detailed documentation "Sensor Instance Manual".

Query and evaluation of Temperature value:

The temperature value is made up of the input value and the input value latch. The number of relevant bits is specified via the resolution:

Query Resolution → answer: 0x0A

0x0A [hex] = 10 [dec]: the information is contained in 10 bits:

Query Input Value → answer: 0x6C

Query Input Value Latch → answer: 0x9B

0x6C = **0110 1100**

0x9B = **10**01 1011

→ 0110 1100 10 = 434 [dec]

For the DALI-2 CS THP temperature sensor the resolution is 0.1°C, the value range is: -20°C to + 80°C (this information can be found in the sensor datasheet, but can also be queried

from the device, see next example for more information and table 6 on page 31).

Evaluating the returned value with the input of resolution and value range:

➔ $434 * 0.1°C = 43.4°C$
➔ $43.4°C - 20°C = \mathbf{23.4\ °C}$

More details on temperature value query and evaluation

Details on Evaluation:
Information on the resolution and value range is not only available from the data sheet but can also be queried (see next section "Details on Querying):

The value is then made up as follows:

$$Value[unit] = Input\,Value \cdot \frac{ValueMultiplicator}{ValueDivisor} + Offset \cdot \frac{OffsetMultiplicator}{OffsetDivisor}$$

From the table on page 21 or the answers from the queries (see next section "Details on Querying") these apply to the temperature instance:

	[hex]	[dec]
Value Multiplicator	0x01	1
Value Divisor	0x0A	10
Offset MSB und LSB	0x62E3	25315
Offset Multiplicator	0x01	1
Offset Divisor	0x64	100
Unit	0x00	Kelvin

Putting these values into the formula:

$$T[K] = InputValue\frac{1}{10} + 25315\frac{1}{100}$$

$$= \frac{InputValue}{10} + 253.15$$

$$= \frac{434}{10} + 253.15 = 296.55\ K$$

$$T[°C] = T[K] - 273.15 = \mathbf{23.4°C}$$

Details on Querying:
A query (24bit DALI frame) consists of:

device address*2+1	instancenr.	query command code

In this example we have a sensor with:
DALI-2 address: A0[2]
temperature instance: instancenr. 2

Query command codes:

QUERY VALUE MULTIPLICATOR	0x40
QUERY VALUE DIVISOR	0x41
QUERY OFFSET MSB	0x42
QUERY OFFSET LSB	0x43
QUERY OFFSET MULTIPLICATOR	0x44
QUERY OFFSET DIVISOR	0x45
QUERY UNIT	0x46
QUERY RESOLUTION	0x81

QUERY of e.g. Resolution

device address*2+1	instancenr.	query command code
01	02	81

The read unit value can be assigned from the following table:

Wert	**Einheit**
0	Thermodynamic temperature [K]
1	CO_2-eq (CO_2 equivalent) [ppm]
12	Relative humidity [%]
15	Barometric pressure [hPa]
16	IAQ (Indoor Air Quality) [1]

These values and assignment of units are specific to Lunatone sensors

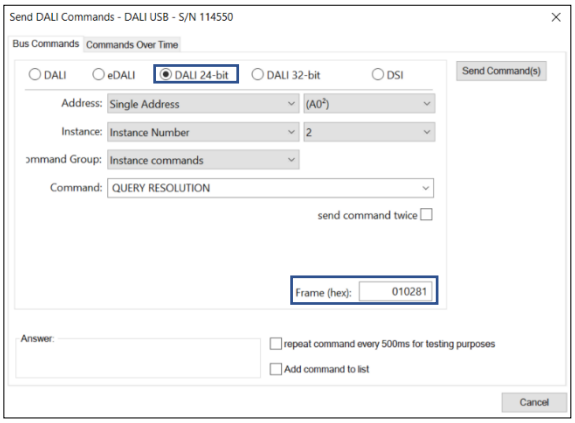
The answers to all above queries for the temperature instance are:

Type	Hex Data	Address	Command
DALI24	01 02 40	A0, iN2	QUERY VALUE MULTIPLICATOR
DALI8 Answer	01		= 1 (0x01)
DALI24	01 02 41	A0, iN2	QUERY VALUE DIVISOR
DALI8 Answer	0A		= 10 (0x0A)
DALI24	01 02 42	A0, iN2	QUERY VALUE MSB
DALI8 Answer	62		= 98 (0x62)
DALI24	01 02 43	A0, iN2	QUERY VALUE LSB
DALI8 Answer	E3		= 227 (0xE3)
DALI24	01 02 44	A0, iN2	QUERY OFFSET MULTIPLICATOR
DALI8 Answer	01		= 1 (0x01)
DALI24	01 02 45	A0, iN2	QUERY OFFSET DIVISOR
DALI8 Answer	64		= 100 (0x64)
DALI24	01 02 46	A0, iN2	QUERY UNIT
DALI8 Answer	00		= 0 (0x00)

The answers for all generic instances are listed in table 5 on page 21.

How to send queries:

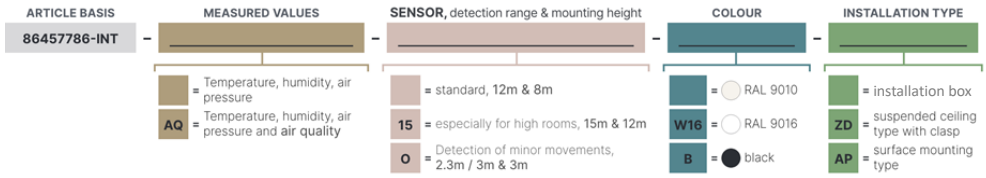
Queries can be sent from the DALI Cockpit > DALI Bus > DALI Commands..:



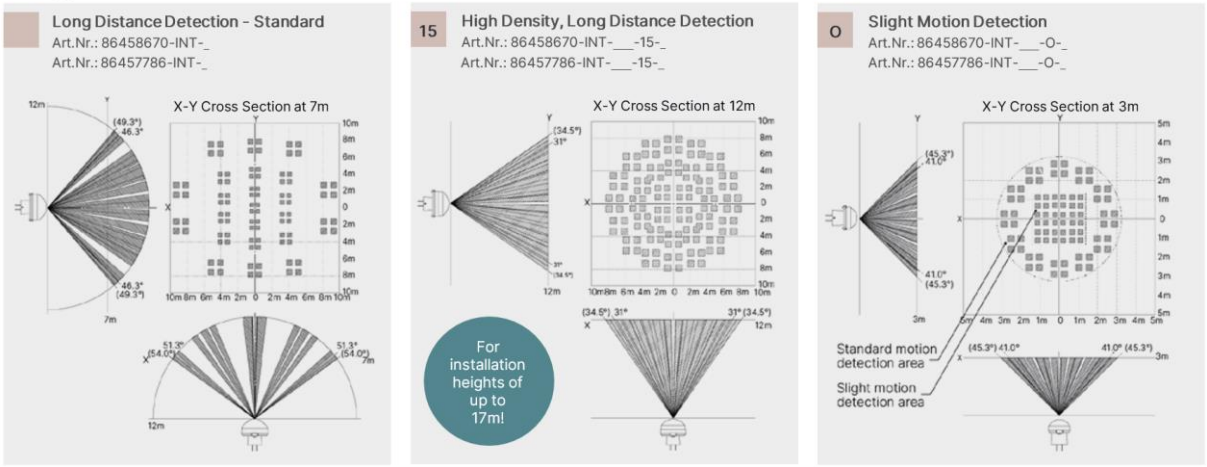
Type	Hex Data	Address	Command
DALI24 Inst Query	01 02 81	A0, iN2	QUERY RESOLUTION
DALI8 Answer	0A		= 10 (0x0A)
DALI24 Inst Query	01 02 8C	A0, iN2	QUERY INPUT VALUE
DALI8 Answer	6C		= 108 (0x6C)
DALI24 Inst Query	01 02 8D	A0, iN2	QUERY INPUT VALUE LATCH
DALI8 Answer	9B		= 155 (0x9B)

Purchase Order Information

DALI-2 CS THP Integration: measurement of motion, light intensity, temperature, humidity, air pressure and optional air quality (-AQ)



Lens types:



Installation types:

Standard Version

Art.Nr. 86457786-INT: DALI-2 CS Integration THP
Sensor module: motion and light intensity, temperature, humidity, air pressure
Instance mode for Integration, pure white (RAL9010), back box installation

- **Art.Nr. 86457786-INT-AP**: pure white (RAL9010), surface mounting
- **Art.Nr. 86457786-INT-ZD**: pure white (RAL9010), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-W16**: traffic white (RAL9016), back box installation
- **Art.Nr. 86457786-INT-W16-AP**: traffic white (RAL9016), surface mounting
- **Art.Nr. 86457786-INT-W16-ZD**: traffic white (RAL9016), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-B**: black, back box installation
- **Art.Nr. 86457786-INT-B-AP**: black, surface mounting
- **Art.Nr. 86457786-INT-B-ZD**: black, suspended ceiling (spring)

Art.Nr. 86457786-INT-AQ: DALI-2 CS Integration THP-AQ
Sensor module: motion and light intensity, temperature, humidity, air pressure, air quality, eCO2
Instance mode for Integration, pure white v(RAL9010), back box installation

- **Art.Nr. 86457786-INT-AQ-AP**: pure white (RAL9010), surface mounting
- **Art.Nr. 86457786-INT-AQ-ZD**: pure white (RAL9010), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-AQ-W16**: traffic white (RAL9016), back box installation
- **Art.Nr. 86457786-INT-AQ-W16-AP**: traffic white (RAL9016), surface mounting
- **Art.Nr. 86457786-INT-AQ-W16-ZD**: traffic white (RAL9016), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-AQ -B**: black, back box installation
- **Art.Nr. 86457786-INT-AQ -B-AP**: black, surface mounting
- **Art.Nr. 86457786-INT-AQ -B-ZD**: black, suspended ceiling (spring)

Hall Version *- for halls / high ceilings: presence detection range 15m*

Art.Nr. 86457786-INT-15: DALI-2 CS Integration THP, presence detection range 15m,
Sensor module: motion and light intensity, temperature, humidity, air pressure
Instance mode for Integration, pure white (RAL9010), back box installation

- **Art.Nr. 86457786-INT-15-AP**: pure white (RAL9010), surface mounting
- **Art.Nr. 86457786-INT-15-ZD**: pure white (RAL9010), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-15-W16**: traffic white (RAL9016), back box installation
- **Art.Nr. 86457786-INT-15-W16-AP**: traffic white (RAL9016), surface mounting
- **Art.Nr. 86457786-INT-15-W16-ZD**: traffic white (RAL9016) suspended ceiling (spring)
- **Art.Nr. 86457786-INT-15-B**: black, back box installation
- **Art.Nr. 86457786-INT-15-B-AP**: black, surface mounting
- **Art.Nr. 86457786-INT-15-B-ZD**: black, suspended ceiling (spring)

Art.Nr. 86457786-INT-AQ-15: DALI-2 CS Integration THP-AQ, presence detection range 15m,
Sensor module: motion and light intensity, temperature, humidity, air pressure, air quality, eCO2
Instance mode for Integration, pure white (RAL9010), back box installation

- **Art.Nr. 86457786-INT-AQ-15-AP**: pure white (RAL9010), surface mounting
- **Art.Nr. 86457786-INT-AQ-15-ZD**: pure white (RAL9010), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-AQ-15-W16**: traffic white (RAL9016), back box installation
- **Art.Nr. 86457786-INT-AQ-15-W16-AP**: traffic white (RAL9016), surface mounting
- **Art.Nr. 86457786-INT-AQ-15-W16-ZD**: traffic white (RAL9016), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-AQ-15-B**: black, back box installation
- **Art.Nr. 86457786-INT-AQ-15-B-AP**: black, surface mounting
- **Art.Nr.: 86457786-INT-AQ-15-B-ZD**: black, suspended ceiling (spring)

Office Version *- for office applications: detection of small movement / seated people*

Art.Nr. 86457786-INT-O: DALI-2 CS Integration THP , for office applications (detection of seated persons)
Sensor module: motion and light intensity, temperature, humidity, air pressure
Instance mode for Integration, pure white (RAL9010), back box installation

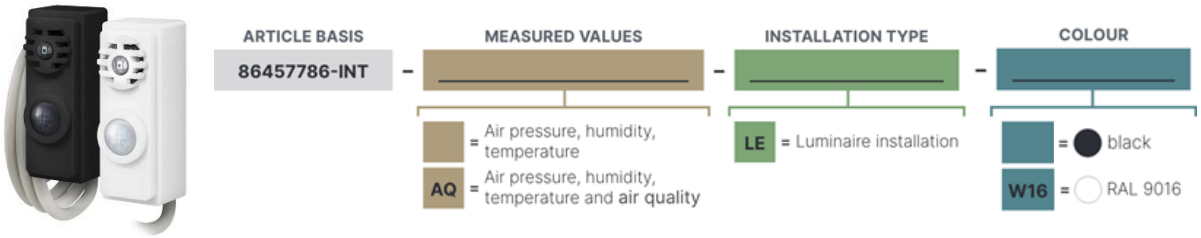
- **Art.Nr. 86457786-INT-O-AP**: pure white (RAL9010), surface mounting
- **Art.Nr. 86457786-INT-O-ZD**: pure white (RAL9010), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-O-W16**: traffic white (RAL9016), back box installation
- **Art.Nr. 86457786-INT-O-W16-AP**: traffic white (RAL9016), surface mounting
- **Art.Nr. 86457786-INT-O-W16-ZD**: traffic white (RAL9016), suspended ceiling (spring)
- **Art.Nr. 86457786-INT-O-B**: black, back box installation
- **Art.Nr. 86457786-INT-O-B-AP**: black, surface mounting
- **Art.Nr. 86457786-INT-O-B-ZD**: black, suspended ceiling (spring)

Art.Nr. 86457786-INT-AQ-O: DALI-2 CS Integration THP-AQ, for office applications (detection of seated persons),
Sensor module: motion and light intensity, temperature, humidity, air pressure, air quality, eCO2
Instance mode for Integration, pure white (RAL9010), back box installation

Art.Nr. 86457786-INT-AQ-O-AP: pure white (RAL9010), surface mounting
Art.Nr. 86457786-INT-AQ-O-ZD: pure white (RAL9010), suspended ceiling (spring)
Art.Nr. 86457786-INT-AQ-O-W16: traffic white (RAL9016), back box installation
Art.Nr. 86457786-INT-AQ-O-W16-AP: traffic white (RAL9016), surface mounting
Art.Nr. 86457786-INT-AQ-O-W16-ZD: traffic white (RAL9016), suspended ceiling (spring)
Art.Nr. 86457786-INT-AQ-O-B: black, back box installation
Art.Nr. 86457786-INT-AQ-O-B-AP: black, surface mounting
Art.Nr. 86457786-INT-AQ-O-B-ZD: black, suspended ceiling (spring)

Luminaire installation Version

DALI-2 CS THP Integration - for installation in luminaires:
measurement of motion, light intensity, temperature, humidity, air pressure and optional air quality (-AQ)



Art.Nr. 86457786-INT-LE: DALI-2 CS Integration THP for installation in luminaires,
Sensor module: motion and light intensity, temperature, humidity, air pressure
Instance mode for Integration, luminaire installation, black

Art.Nr. 86457786-INT-AQ-LE: DALI-2 CS Integration THP-AQ for installation in luminaires,
Sensor module: motion and light intensity, temperature, humidity, air pressure, air quality, eCO2
Instance mode for Integration, , luminaire installation, black

Art.Nr. 86457786-INT-LE-W16: DALI-2 CS Integration THP for installation in luminaires,
Sensor module: motion and light intensity, temperature, humidity, air pressure
Instance mode for Integration, luminaire installation, white RAL9016

Art.Nr. 86457786-INT-AQ-LE-W16: DALI-2 CS Integration THP-AQ for installation in luminaires,
Sensor module: motion and light intensity, temperature, humidity, air pressure, air quality, eCO2
Instance mode for Integration, , luminaire installation, white RAL9016

Version DALI-2 CS Integration – motion and light sensor

DALI-2 Combi sensor integration: www.lunatone.com/en/product/dali-2-cs-integration/

Version with Application Controller

DALI-2 Combi Sensor: www.lunatone.com/en/product/dali-2-cs/

Additional Information and Equipment

DALI-Cockpit – DALI system configuration tool, free when using a Lunatone interface device
https://www.lunatone.com/en/product/dali-cockpit/

Lunatone sensor instance manual
https://www.lunatone.com/wp-content/uploads/2022/11/Lunatone_DALI-2_Sensor_Instances_EN_M0026.pdf

Instance guide
https://www.lunatone.com/wp-content/uploads/2021/10/DALI-2_Instance-Guide_EN_M0024.pdf

Lunatone DALI products
http://www.lunatone.at/en/

Lunatone datasheets and manuals
http://lunatone.at/en/downloads/

Contact

Technical Support: support@lunatone.com

Requests: sales@lunatone.com

www.lunatone.com

Disclaimer

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The function in installations with other devices must be tested for compatibility in advance.