

SAM15/D2

HF Highbay | D4i Input Device | Zhaga Book 18 Standard

HYTRONIK®
SENSORS & LIGHTING CONTROL



Benefits

Compact: Small IP65 Zhaga Book 18 sensor

DALI-2 feature: Occupancy (part 303) Daylight (part 304)

Standardized: DALI-2 protocol certified as D4i Type B

Applications

UFO luminaires up to 15m height

Warehouse/ Logistic

Outdoor/Street lights

Check out the complete system solution on the website:

<https://www.hytronik.com>



Product Description

SAM15/D2 is a high-bay HF motion sensor with IP65 protection and up to 15m mounting height, ideal for industrial and outdoor applications. It is compatible with Zhaga Book 18 for tool-free installation into various luminaires. The sensor is D4i certified and complies with the IEC 62386 (2014) standard as a DALI-2 input device. It can be powered by the AUX supply from a D4i driver or luminaire, and also supports an external power supply when no D4i DALI driver is available.

Hardware Features

See additional details at the end of datasheet



D4i input device (Type B)



Zhaga Book 18 standard



IP65 design



Robust HF Antenna Design



5-year warranty

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Specifications

Main Capabilities

Dimming (Output) Interface	DALI
Voltage Type	DC
Stand-by Power	<0.5W
Sensor principle	High Frequency (microwave)

Electrical Data

Operating voltage (AUX.)	12-36 VDC
DALI Input voltage	9.5-22.5V
DALI Consumption Current	2mA
Quiescent current (AUX.)	15mA
In-rush current (AUX.)	< 50mA

Sensor Data

Detection angle	360°
Max. Detection range (Ø)	Max installation height: 15m (forklift), 12m (single person) Max detection range: Ø20m (forklift), Ø12m (single person)
Lux range	0~1023 lux
Sensitivity	30% / 50% / 75% / 100%

Technical

Operation temperature	Ta: -20°C ~ +50°C
Storage temperature	-40°C - +70°C
Relative humidity	10% - 90%
IP rate	IP65
Insulation	Class II

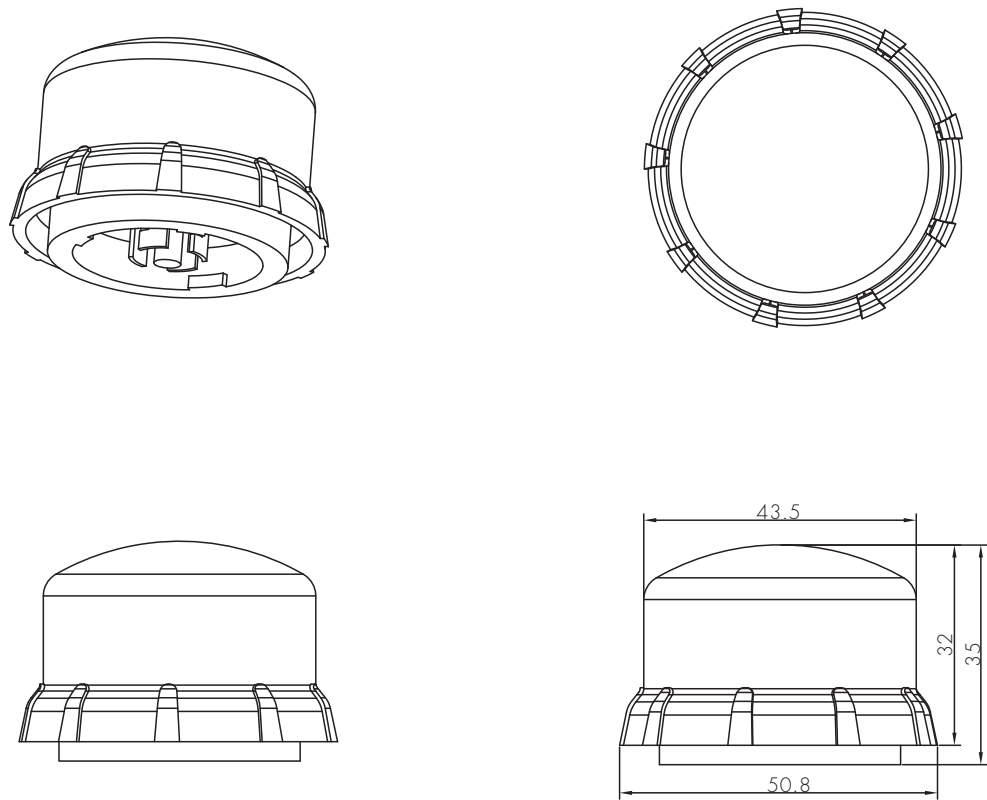
Standards

EMC	EN61547, EN50015
LVD	EN61347-1 EN61347-2-11
RED	EN300440, EN300328, EN301489-1/-3/-17, EN50663
Certification	CE, UKCA, EMC, RED
Compliance	RoHs, Reach
DALI standard	IEC62386-101/103
D4i	Single master, Type B

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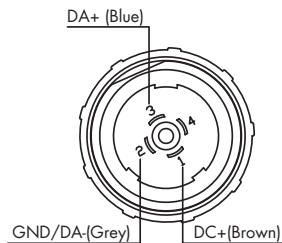
Dimension Drawing



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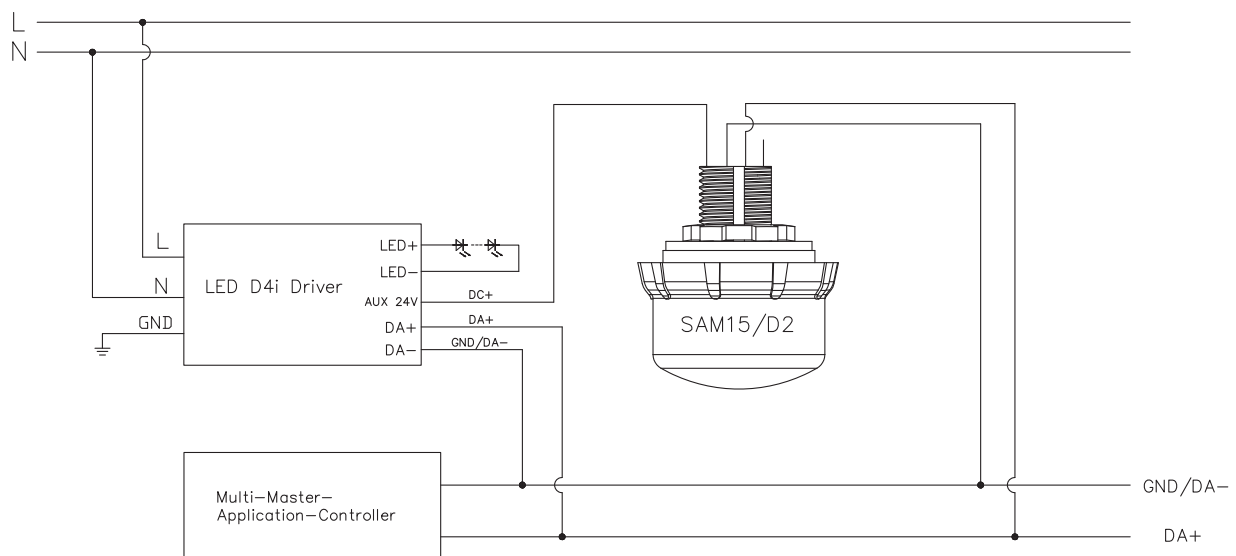
Wiring Diagram Notes



- The total current on the DALI bus must not exceed 250mA.
- Terminal block 4 is left unpopulated by default. No wiring required.
- SAM15/D2 has been used as DALI-2 input device to only report DALI instance(light sensor instance and motion sensor instance) to DALI-2 application controller, who is the "main brain" to process the data communication between input devices and the control gear and assign different function.

Wiring Diagram 1

D4i Driver with Built-in AUX

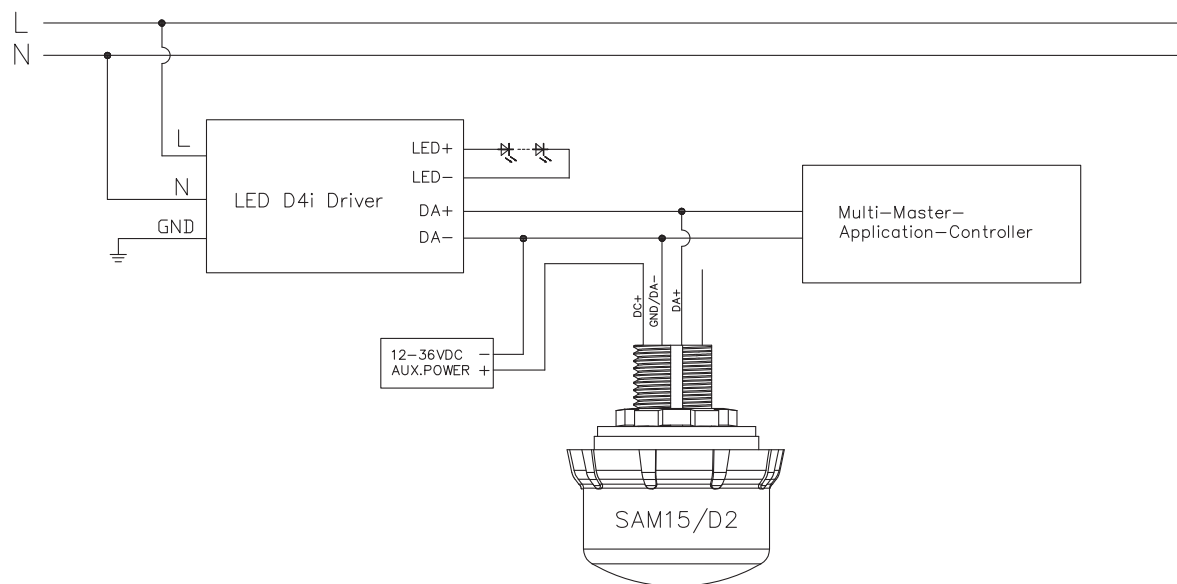


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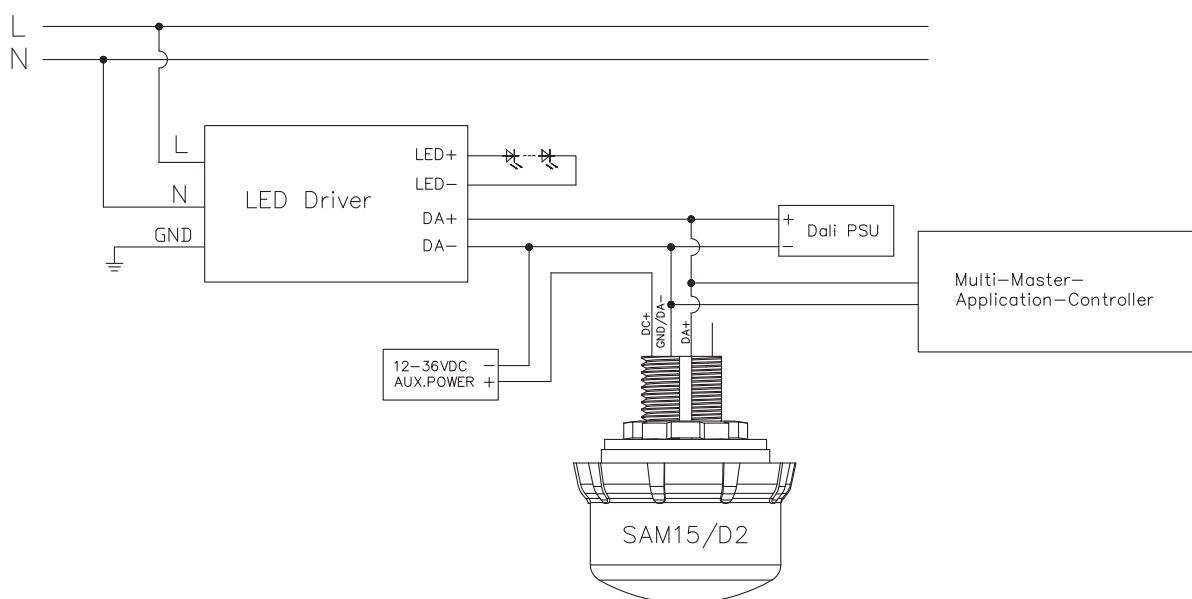
Wiring Diagram2

D4i Driver with External AUX



Wiring Diagram3

Standard Driver with External AUX & PSU



Commissioning Instructions and Precautions

A. Installation Preparations

1. This product should be installed by a qualified electrician.
2. The detection range is heavily influenced by sensor placement (angle) and different walking paces. It may be reduced under certain conditions.
3. This device does not Supports reading luminaire, energy, and diagnostics data provided by the connected D4i drivers.

Warning: For additional important documents, including installation precautions, product guidelines, and guarantee conditions, please refer to the official downloads.

<https://hytronik.com/service/downloads>

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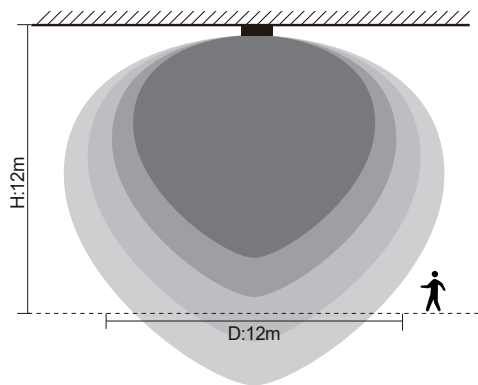
Detection Range

Person

*The sensor detection area shown in this table is based on an open space.
In environments with hard surfaces such as metal racking or glass corridors, the detection range may be extended by up to 30% due to reflections or signal penetration.

The data above is tested under following conditions:

- Single person walking;
- Sensor not connected to any driver that may have soft-on period;
- Testing temperature Ta = 20°C;

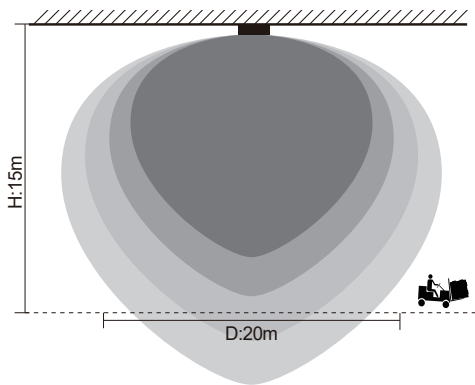


Height (m)	Sensitivity			
	100%	75%	50%	30%
Diameter (Ø:m)				
12	12	9	6	none
8	13	10	6	2
5	14	11	7	5
3	15	12	8	6

Forklift

The data above is tested under following conditions:

- Forklift driving at a speed of 5km/h;
- Sensor not connected to any driver that may have soft-on period;
- Testing temperature Ta = 20°C;



Height (m)	Sensitivity
	100%
	Diameter (Ø : m)
15	20

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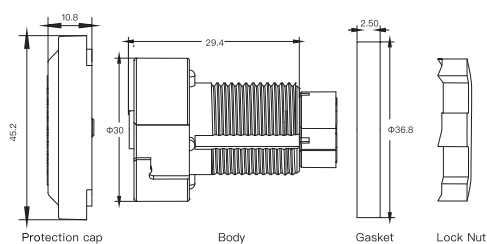
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Compatible Products (for full functionality)

Receptacle Accessory (not included in the package)

The HA18SKT receptacle is designed to be compatible with the SAM15 and HIR15 series products. It provides a Zhaga Book 18 standard interface, suitable for roadway lighting, area lighting, and occupancy lighting applications.

For more details, please refer to <https://hytronik.com/product/ha18skt>



Commissioning Instructions and Precautions

Sensitivity Adjustment

Method 1

Setting the sensitivity can be achieved through the following command combination:

1. "ENABLE WRITE MEMORY": Enable BANK write function.
2. "DTR1:DTR0=0x1:0x2, WRITE MEMORY LOCATION =0x55": Set the Lock byte of BANK1 to 0x55. Here a total of 2 instructions are used.

Set the Lock Byte of BANK1 to 0x55 to unlock the BANK1.

3. "DTR1:DTR0=0x1:0x11, WRITE MEMORY LOCATION = sensing gear value": set the sensitivity of BANK1 to "sensing gear value". The first instruction is fixed and is used to locate the bank where the sensitivity is stored. Sensing gear value can be selected from 0x1 to 0x4, 0x1 is the weakest, 0x4 is the strongest.

*Before writing to the bank, two locks need to be unlocked to write normally.

- The first lock is the big lock for all banks. Unlock it with the command "ENABLE WRITE MEMORY".
- The second lock is that each bank has its own Lock byte. When the written value is 0x55, the small lock is unlocked.

*BANK is a memory space freely defined by the manufacturer. Writing a value after unlocking has two steps:

- Specify the write address, and pass in the address through DTR0 and DTR1.
- Pass in the written value with the write command "WRITE MEMORY LOCATION". This command will return the written value after the write is successful. Write fails without return value.

The following is an example of an instruction to set the sensitivity to 100%.

Type	Addr	Command	Data	Delay	Answer
DALI24	BCast	ENABLE WRITE MEMORY		100...	
DALI24	BCast	ENABLE WRITE MEMORY		100...	
DALI24		DTR1:DTR0	1:2	100...	
DALI24		WRITE MEMORY LOCATION	85	100...	85
DALI24		DTR1:DTR0	1:17	100...	
DALI24		WRITE MEMORY LOCATION	4	100...	4

Method 2

The motion sensor only sends motion events. No further signals or commands will be sent. Sensor sensitivity ranges from 0 to 100%.

*Values of "detectionRange" and "detectionSensitivity" shall have the following meaning:

- [0,100]: 0-100%. 0 is the lowest detection range or detection sensitivity, 100 is the highest.

- 255: Adjustment not supported.

*Set sensitivity: 0x26

*Query sensitivity: 0x2B

Command name	Address byte	Instance byte	Opcode byte	DTR0	DTR1	DTR2	Answer	Send twice	See subclause	Command subclause
CATCH MOVEMENT	Device	Instance	0x20						9.4.6	11.7.2
SET HOLD TIMER (DTR0)	Device	Instance	0x21	✓				✓	9.5.1	11.8.3
SET REPORT TIMER (DTR0)	Device	Instance	0x22	✓				✓	9.5.2	11.8.4
SET DEADTIME TIMER (DTR0)	Device	Instance	0x23	✓				✓	9.5.3	11.8.5
CANCEL HOLD TIMER	Device	Instance	0x24						9.5.1	11.7.3
SET SENSITIVITY (DTR0)	Device	Instance	0x26	✓				✓	9.5.7	11.8.7
QUERY INSTANCE CAPABILITIES	Device	Instance	0x29				✓		9.5.6	11.9.7
QUERY SENSITIVITY	Device	Instance	0x2B				✓		9.5.7	11.9.9
QUERY DEADTIME TIMER	Device	Instance	0x2C				✓		9.5.3	11.9.3
QUERY HOLD TIMER	Device	Instance	0x2D				✓		9.5.1	11.9.4
QUERY REPORT TIMER	Device	Instance	0x2E				✓		9.5.2	11.9.5
QUERY CATCHING	Device	Instance	0x2F				✓		9.5.6	11.9.6

*The valid value range is 0-100, 0-24 is the lowest sensitivity of the first gear, 25-49 is the second gear, 50-74 is the third gear, and 75-100 is the highest sensitivity of the fourth gear.

DALI-2 Instances & Functional Behavior

1. Instances Overview

The multi-sensor implements two DALI-2 standardized instances:

- Instance 0 – Occupancy Sensor (303)
- Instance 1 – Light Sensor (304)

Each instance is uniquely numbered within the device.

2. Instances-General

Each instance can be configured independently. Settings that apply identically to all sensor instances are described in this section.

Instance-specific parameters are detailed in the following sections for each instance type.

General Instance Settings

- Enable / Disable

Each instance can be individually enabled or disabled. Disabled instances do not send events or update measured values, but their values can still be obtained via Query commands, and all DALI-2 configuration commands remain supported.

- Event Scheme

The event scheme determines the addressing information included in each event message. This information is required for recognition and filtering of events on the DALI bus. Five options are available:

1. Instance Addressing: instance type + instance number
2. Device Addressing: device address + instance type
3. Device/Instance Addressing: device address + instance number
4. Device Group Addressing: device group + instance type
5. Instance Group Addressing: instance group + instance type

Definitions:

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 Priority**

Event priority defines the order in which events are transmitted when multiple events occur simultaneously. Priority 2 is the highest, and priority 5 is the lowest.

- **Dead Time**

Dead time can be configured for each instance. It defines the minimum interval that must pass before the same event can be transmitted again, even if the measured value has changed. Dead time may be disabled if not required.

- **Report Time**

If the measured value does not change, the event is sent cyclically based on the configured report time. The report time can be set for each instance. It determines the maximum time between a sent event and re-sending

- **Hysteresis**

Not every value change generates an event. Hysteresis defines the percentage change required to trigger a new transmission. The hysteresis band is not symmetrical:

1. Increasing value: an event occurs only if the next value is below the previous value minus hysteresis, or above the previous value.
2. Decreasing value: an event occurs only if the next value is above the previous value plus hysteresis, or below the previous value.
3. Hysteresis Min: defines the minimum hysteresis value that cannot be undercut.

3. Instance 0 – Motion (303)

- **Overview**

Instance 0 is a DALI-2 standardized instance defined in IEC 62386-303 for motion-detection sensors. All functional behaviors follow the standard, and the instance is fully DALI-2 certified.

- **State Definitions**

The sensor operates using three possible states:

1. People in the room and movement — (0xFF)
2. People in the room and no movement — (0xAA)
3. Empty room — (0x00)

State Transition Logic

If movement is detected, the sensor immediately enters the state “People in the room and movement” (0xFF).

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”. (0xAA).

After the configured hold time expires, the state transitions to “Empty room” (0x00).

- **Hold Time**

Hold time defines the duration before the sensor transitions from “People in the room and no movement” (0xAA) to “Empty room” (0x00).

If movement is detected during this time the state is changed back to: “People in the room and movement” (0xFF) . (min. 1 second)

- **Query Input Value**

The current occupancy status can be retrieved with a DALI Query command. Possible return values: 0x00, 0xAA, 0xFF

- **Event**

The sensor status is transmitted by events. The following event information is available:

Event name	Event Information	Description
No movement	00 0000 ---0b	No movement detected. Corresponding trigger is the 'No movement' trigger.
Movement	00 0000 ---1b	Movement detected. Corresponding trigger is the 'Movement' trigger.
Vacant	00 0000 -00-b	The area has become vacant. Corresponding trigger is the 'Vacant' trigger.
Still vacant	00 0000 -10-b	The area is still vacant. The event occurs at regular intervals as long as the vacant condition holds. Corresponding trigger is the 'Repeat' trigger.
Occupied	00 0000 -01-b	The area has become occupied. Corresponding trigger is the 'Occupied' trigger.
Still occupied	00 0000 -11-b	The area is still occupied. The event occurs at regular intervals as long as the occupied condition holds. Corresponding trigger is the 'Repeat' trigger.
Movement sensor	00 0000 1---b	The current event is triggered by a movement based sensor.
	1x xxxx xxxxb	Reserved.
	01 xxxx xxxxb	
	00 1xxx xxxxb	
	00 01xx xxxxb	
	00 001x xxxxb	
	00 0001 xxxxb	

Refer to IEC 62386-303 for further event encoding details.

- **Event filter**

The event filter defines for which status change an event is generated.

Filter arrangement:

1. Bit0: Occupied Event active
2. Bit1: Vacant Event active
3. Bit2: Still Vacant/Occupied Event active
4. Bit3: Movement Event active
5. Bit4: No Movement Event active
6. Bit5..Bit7: unused

- **Report Time**

Report time can only be set if the event filter "Repeat" is activated and the events: "Still Vacant" and "Still Occupied" are enabled. The time between sending a "Still-Event" again is determined by the Report Time.

4. Configuring Instance 0 – Occupancy Sensor

1. Set filter (SET EVENT FILTER): 1 Byte, corresponding relationship of each BIT and default value are as follows:

Bit	Description	Value	Default
0	Occupied event enabled?	"1" = "Yes"	1
1	Vacant event enabled?	"1" = "Yes"	1
2	Repeat event enabled?	"1" = "Yes"	0
3	Movement event enabled?	"1" = "Yes"	0
4	No movement event enabled?	"1" = "Yes"	0
5	Reserved	0	0
6	Reserved	0	0
7	Reserved	0	0

Command value: 0x68

2. Set Hold Time – SET HOLD TIMER (DTR0)

1 Byte (1–255), Actual value: HOLD TIMER = 10S, Command value: 0x21

3. Set Report Time – SET REPORT TIMER (DTR0)

1 Byte (0–255), Actual value: REPORT TIMER = 1S, Command value: 0x22

4. Set Dead Time – SET DEAD TIME TIMER (DTR0)

1 Byte (0–255), Actual value: DEAD TIME TIMER = 50 ms, Command value: 0x23

5. Set Sensor Sensitivity – SET SENSITIVITY (DTR0)

1 Byte (0–100), Valid range: 0–15, (0 = highest sensitivity, 15 = lowest sensitivity), Command value: 0x26

6. Query Sensor Sensitivity – SET SENSITIVITY (DTR0)

1 Byte (0–100), Command value: 0x2b

7. Query Instance Resolution – QUERY RESOLUTION

Resolution = 2, Command value: 0x81

8. Query Input Value – QUERY INPUT VALUE

Input values of occupancy sensor (4 values: 0, 0x55, 0xaa, 0xff), This command value: 0x8c

5. Instance 1 – Light Intensity (304)

• Overview

Instance 1 complies with the DALI-2 IEC 62386-304 standard for light-intensity measurement. It is fully DALI-2 certified.

• Measurement Behavior

The current light value (lux) is measured continuously. It can be obtained either using a DALI “Query” command or by receiving automatically generated events.

Measuring range: 0–1000 lux, The resolution differs between queries and generated events. A query supports an event resolution of 10Lux (10Bit).

• Hysteresis

Not every value change generates an event. Hysteresis defines the percentage change required to trigger a new transmission. The hysteresis band is not symmetrical:

1. Increasing value: an event occurs only if the next value is below the previous value minus hysteresis, or above the previous value.
2. Decreasing value: an event occurs only if the next value is above the previous value plus hysteresis, or below the previous value.
3. Hysteresis Min: defines the minimum hysteresis value that cannot be undercut.

- **Event Filter**

This instance generates a single light-level event with 10-bit resolution (0-1023 lux in 10-lux steps). If the event filter is disabled, no events will be sent.

- **Event**

The illuminance level is transmitted by event. The following event information is available:

Event name	Event Information	Description
Illuminance level report	Illuminance Event	An illuminance level report, passing the actual illuminance level along.

Refer to IEC 62386-304 for further event encoding details.

6. Configuring Instance 1 – Light Sensor

1. Set filter (SET EVENT FILTER): 1 Byte, only 1 BIT used, corresponding relationship and default value are as follows:

Bit	Description	Value	Default
0	Illuminance level event enabled?	"1" = "Yes"	1
1	Reserved	0	0
2	Reserved	0	0
3	Reserved	0	0
4	Reserved	0	0
5	Reserved	0	0
6	Reserved	0	0
7	Reserved	0	0

Command value: 0x68

2. Set Report Time – SET REPORT TIMER (DTR0)

1 Byte (0–255) , Actual value: REPORT TIMER = 1S, Command value: 0x30

3. Set Dead Time – SET DEAD TIME TIMER (DTR0)

1 Byte (0–255), Actual value: DEAD TIME TIMER = 50 ms, Command value: 0x32

4. Set Hysteresis – SET HYSTERESIS (DTR0)

1 Byte (0–25%), Actual value: HYSTERESIS × current illuminance, Command value: 0x31

5. Set Hysteresis Min – SET HYSTERESIS MIN (DTR0)

1 Byte (0–255), Command value: 0x33

6. Query instance resolution – QUERY RESOLUTION

Resolution = 10, Command value: 0x81

7. Query instance current value – QUERY INPUT VALUE

Current illuminance (0–1000 lux), Command value: 0x8c

8. Query Input Value Latch – QUERY INPUT VALUE LATCH

Command value: 0x8d

Commissioning Instructions and Precautions

A. Installation Preparations

1. This product should be installed by a qualified electrician.

B. DALI-2 Compliance

2. This product has been tested in accordance with IEC 62386 and complies with the relevant DALI-2 application parts.

DALI-2 testing was performed using the official DALI test sequence software (version 2.3.3.0), covering the applicable IEC 62386 parts (e.g. Part 101, Part 103, Part 303, Part 304, Part 351). DALI-2 certification verifies compliance within the defined test scope.

However, certification does not eliminate the possibility of system-level compatibility issues arising from differences in device implementation or system design among manufacturers. Therefore, functional verification and on-site testing are required as part of the final system commissioning to ensure proper operation and compliance with project requirements.

Warning: For additional important documents, including installation precautions, product guidelines, and guarantee conditions, please refer to <https://hytronik.com/service/downloads>

Extension

5-year Warranty



All Hytronik products are supplied with a 5-year warranty against defect in design or manufacture. The warranty applies to all electronic control gears supplied by Hytronik and is applicable to the party to which the sale was made. The warranty is not transferable to a 3rd party and compatibility with external components are the responsibility of the finished goods manufacturer. With today's multi-national sourcing strategies, we offer an unrivalled universal warranty with support available in regions where Hytronik has its own office or authorized representation, regardless of where the Hytronik product was purchased. Furthermore, we operate a 24-hour response policy to any claim. The full warranty policy is available upon request or from our website.

D4i input device (Type B)



This product has been certified as a DALI-2 input device (Type B). It serves as a sensing node that reports occupancy and ambient light data to the DALI-2 application controller. The application controller functions as the “main brain” of the DALI system, managing communication between input devices and control gear to achieve intelligent lighting control. The sensor itself does not directly control lighting loads but provides accurate sensing data for intelligent lighting control and system automation.

Zhaga Book 18 standard



Our product's modular architecture and interface design adhere to Zhaga Book 20 technical guidelines, enabling streamlined compatibility with standardized lighting ecosystems. By prioritizing core specifications for interoperability, we deliver flexible solutions optimized for modern applications.

Robust HF Antenna Design



The HF sensor uses a 5.8 GHz high-frequency antenna and advanced RF filtering techniques to ensure stable motion detection performance even in environments crowded with wireless signals (WiFi, Bluetooth, 5G, etc.). It discriminates genuine human movement (Doppler shifts) from interference, avoids false triggers and flickering, and reduces maintenance efforts, enabling reliable occupancy sensing and real energy savings in challenging installations.

IP65 design



Our product's IP65-rated enclosure ensures complete protection against dust ingress and low-pressure water jets, enabling reliable performance in demanding indoor and outdoor environments. By providing robust environmental sealing, the sensor maintains long-term stability and consistent operation in spaces such as warehouses, parking areas, and industrial facilities.

Check out for further explanation of features

<https://hytronik.com/solutions/lighting-control-features>