

DALI-2 HF Sensor

HCD405D2/H

DALI-2 command

HYTRONIK®



Product Description

HCD405D2/H built-in microwave sensor has been certified as DALI-2 input device with daylight sensor instance and HF motion sensor instance. It is a high-bay motion sensor, with capability of up to 1.5m installation height. HCD405D2/H is suitable for any typical indoor applications such as office, classroom, car park, warehouse and other commercial/industrial areas.



Hardware Features



DALI-2 multi-sensor input device



Compliant to IEC62386_101, 103, 303, 304



Robust HF antenna design against wireless interference



High-bay (up to 1.5m height)



5-Year Warranty

Technical Data

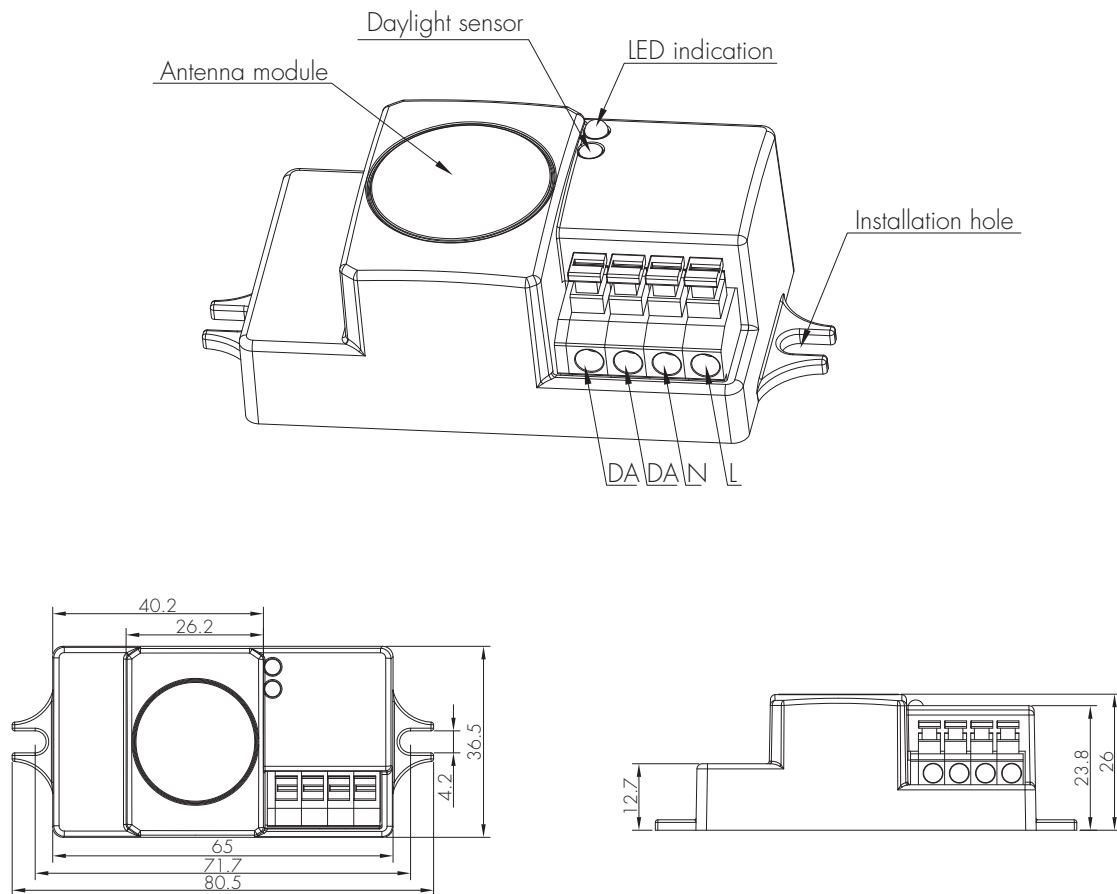
Input Characteristics	
Input	220-240VAC 50/60Hz
Current Consumption	Max. 2mA from DALI Bus
Power Consumption	<1W
DALI Input	9.5-22.5V
Warming-up	20s

Safety and EMC	
EMC standard (EMC)	EN55015, EN61547, EN61000-3-2, EN61000-3-3
Safety standard (LVD)	EN61347-1/-2-11
Radio Equipment (RED)	EN300440, EN301489-1/-3, EN50663
Certification	CB, CE, EMC, RED, RCM
Compliance	IEC62386_101, 103, 303, 304

Sensor Data	
Sensor principle	High Frequency (microwave)
Operation frequency	5.8GHz +/- 75MHz
Transmission power	<0.5mW
Detection range(Max.)	Max installation height: 12m (human) Max detection range: 14m (diameter)
Detection angle	30° ~ 150°
Lux range	0~1023 lux

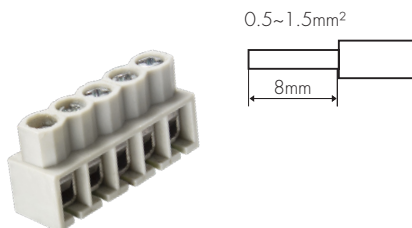
Environment	
Operation temperature	Ta: -20°C ~ +60°C
Case temperature (Max.)	Tc: +75°C
Storage temperature	-35°C ~ 70°C
Relative humidity	20 ~ 90%
IP rating	IP20
Insulation	Class II

Mechanical Structure & Dimensions



* Note: We recommend the mounting distance between sensor to sensor should be more than 2m to prevent sensors from false-triggering.

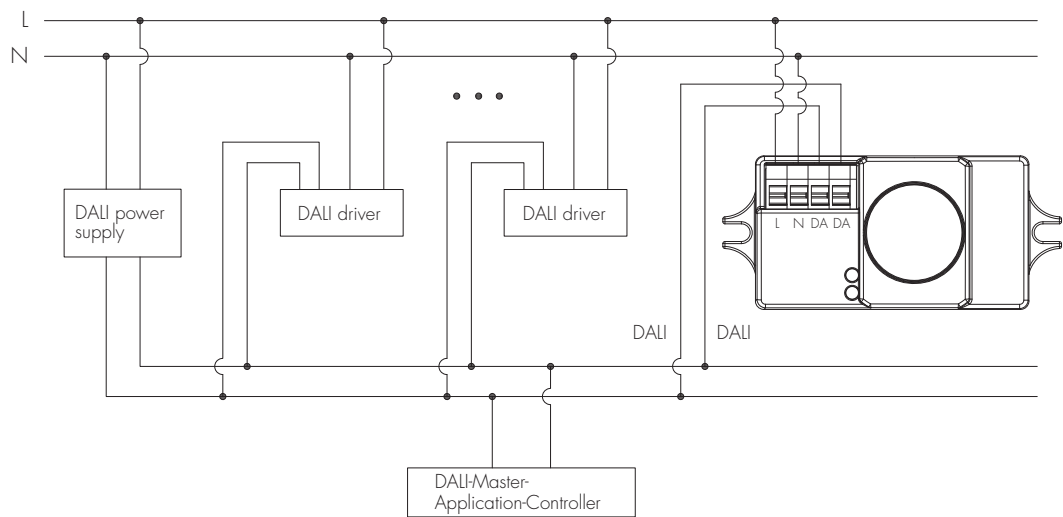
Wire Preparation



To make or release the wire from the terminal, use a screwdriver to push down the button.

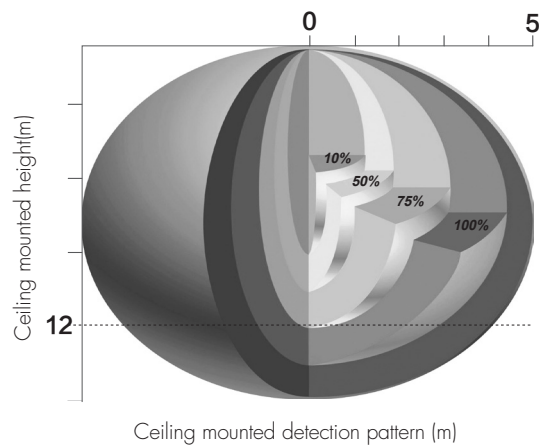
1. 200 metres (total) max. for 1mm² CSA (Ta = 50°C)
2. 300 metres (total) max. for 1.5mm² CSA (Ta = 50°C)

Wiring Diagram



*Note: HCD405D2/H 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.

Detection Pattern



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

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 DEAO TIME 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 2.2.0.0), covering the applicable IEC 62386 parts (e.g. Part 101, Part 103, Part 303, Part 304). 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>

Additional Information / Documents

1. To learn more about detailed product features/functions, please kindly refer to
<https://hytronik.com/product/hcd405d2-h>
2. Regarding precautions for Microwave sensor installation and operation, please kindly refer to:
<https://hytronik.com/service/downloads> (Microwave Sensors Precautions for Product Installation and Operation)
3. Data sheet is subject to change without notice. Please always refer to the most recent release on
<https://hytronik.com/products/motion-daylight-sensors>
4. Regarding Hytronik standard guarantee policy, please kindly refer to
<https://hytronik.com/service/downloads> (Guarantee Conditions document)