IEC 62386-304

Edition 1.1 2024-04
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Digital addressable lighting interface –
Part 304: Particular requirements – Input devices – Light sensor

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IEC 62386-304:2017-05+AMD1:2024-04 CSV(en)

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DIGITAL ADDRESSABLE LIGHTING INTERFACE –

Part 304: Particular requirements – Input devices – Light sensor

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62386-304 edition 1.1 contains the first edition (2017-05) [documents 34C/1314/FDIS and 34C/1334/RVD] and its amendment 1 (2024-04) [documents 34/1014/CDV and 34/1079A/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

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International Standard IEC 62386-304 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Part 304 of IEC 62386 is intended to be used in conjunction with:

- Part 101, which contains general requirements for system components;
- Part 103, which contains general requirements for control devices.

A list of all parts in the IEC 62386 series, published under the general title: *Digital addressable lighting interface*, can be found on the IEC website.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

IEC 62386 contains several parts, referred to as series. The 1xx series includes the basic specifications. Part 101 contains general requirements for system components, Part 102 extends this information with general requirements for control gear and Part 103 extends it further with general requirements for control devices.

The 2xx parts extend the general requirements for control gear with lamp specific extensions (mainly for backward compatibility with Edition 1 of IEC 62386) and with control gear specific features.

The 3xx parts extend the general requirements for control devices with input device specific extensions describing the instance types as well as some common features that can be combined with multiple instance types.

This first edition of IEC 62386-304 is intended to be used in conjunction with ~~IEC 62386-101:2014, IEC 62386-101:2014/AMD1:—~~ IEC 62386-101:2022, ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022. The division of IEC 62386 into separately published parts provides for ease of future amendments and revisions. Additional requirements will be added as and when a need for them is recognized.

The setup of the standards is graphically represented in Figure 1 below.

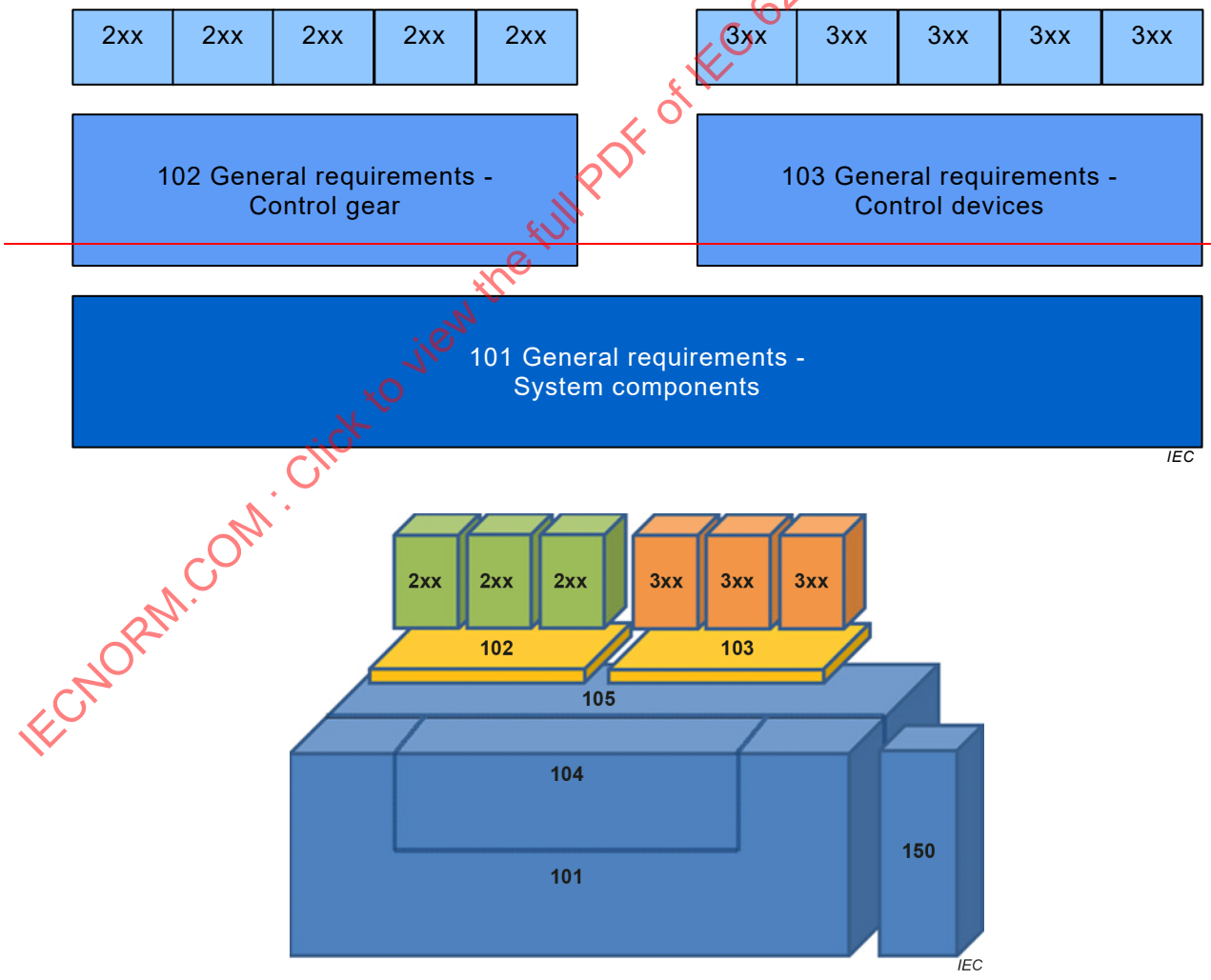

Figure 1 – IEC 62386 graphical overview

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This document, and the other parts that make up the IEC 62386-300 series, in referring to any of the clauses of IEC 62386-1XX, specifies the extent to which such a clause is applicable and the order in which the tests are to be performed; the parts also include additional requirements, as necessary.

Where the requirements of any of the clauses of IEC 62386-1XX are referred to in this document by the sentence “The requirements of IEC 62386-1XX, Clause “n” apply”, this sentence is to be interpreted as meaning that all requirements of the clause in question of Part 1XX apply, except any which are clearly inapplicable.

The standardization of the control interface for control devices is intended to achieve compatible co-existence and multi-master operation between electronic control gear and lighting control devices, below the level of building management systems. This document describes a method of implementing light sensors.

All numbers used in this document are decimal numbers unless otherwise noted. Hexadecimal numbers are given in the format 0xVV, where VV is the value. Binary numbers are given in the format XXXXXXXXb or in the format XXXX XXXX, where X is 0 or 1; “x” in binary numbers means “don't care”.

The following typographic expressions are used:

Variables: *“variableName”* or *“variableName[3:0]”*, giving only bits 3 to 0 of *“variableName”*.

Time value is expressed in minutes and seconds: mm:ss

Range of values: [lowest, highest]

Command: “COMMAND NAME”

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DIGITAL ADDRESSABLE LIGHTING INTERFACE –

Part 304: Particular requirements – Input devices – Light sensor

1 Scope

~~This part of IEC 62386 specifies a bus system for control by digital signals of electronic lighting equipment which is in line with the requirements of IEC 61347, with the addition of DC supplies.~~

~~This document is only applicable to IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:— input devices that deliver illuminance level information to the lighting control system through light level sensing.~~

~~NOTE Requirements for testing individual products during production are not included.~~

This part of IEC 62386 is applicable to input devices that provide illuminance level information to the lighting control system through light level sensing.

This document is only applicable to input devices complying with IEC 62386-103:2022.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62386-101:~~2014~~2022, *Digital addressable lighting interface – Part 101: General requirements – System components*
~~IEC 62386-101:2014/AMD1:— [1]~~

IEC 62386-103:~~2014~~2022, *Digital addressable lighting interface – Part 103: General requirements – Control devices*
~~IEC 62386-103:2014/AMD1:— [2]~~

IEC 62386-333:~~— [3]~~2018, *Digital addressable lighting interface – Part 333: Particular requirements for control devices – Manual configuration (feature type 33)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62386-101 and IEC 62386-103 and the following apply.

~~[1] Under preparation. Stage at the time of publication: IEC ACDV 62386-101/AMD1:2017.~~

~~[2] Under preparation. Stage at the time of publication: IEC ACDV 62386-103/AMD1:2017.~~

~~[3] Under preparation. Stage at the time of publication: IEC CCDV 62386-333:2017.~~

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- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
instance
illuminance level input signal processing unit of an input device

[SOURCE: IEC 62386-101:~~2014~~2022, 3.29, modified — addition of "illuminance level input"]

3.2
strictly monotonic
either entirely increasing or decreasing without repeating values

~~Note 1 to entry: Function f defined on a subset of the real numbers with real values is called monotonically increasing, if for all x and y such that $x < y$ one has $f(x) < f(y)$, so f preserves the order. Likewise, a function is called monotonically decreasing if, whenever $x < y$, then $f(x) > f(y)$, so it reverses the order. For this document strictly monotonic is defined as monotonically increasing.~~

4 General

4.1 General

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, Clause 4 apply, with the restrictions, changes and additions identified below.

4.2 Version number

In 4.2 of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, "103" shall be replaced by "304", "version number" shall be replaced by "extended version number" and "*versionNumber*" shall be replaced by " *extendedVersionNumber*".

4.3 Insulation

According to ~~IEC 61347-1~~ applicable safety standards, it ~~might~~ can be required that the input device has at least supplementary insulation to accessible parts. This depends on the connected components. In this case special attention should be paid with respect to the sensor(s) being used.

NOTE ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022 requires system components to have at least basic insulation.

5 Electrical specification

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, Clause 5 apply.

6 Interface power supply

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, Clause 6 apply.

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7 Transmission protocol structure

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, Clause 7 apply.

NOTE Subclause 9.4 provides detailed event information applicable to instances.

8 Timing

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, Clause 8 apply.

9 Method of operation

9.1 General

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, Clause 9 apply, with the following restrictions and additions.

9.2 Instance type

The instance type (*"instanceType"*) shall be equal to 4.

9.3 Input signal and value

~~The *"inputValue"* shall indicate the illuminance of the light at the sensor surface.~~ The measured value shall contain the measured illuminance with a precision of "*resolution*" bits and shall be encoded in "*inputValue*" as described in IEC 62386-103:2022, 9.8.2. The ~~resulting *"inputValue"*~~ measured value shall be a strictly monotonic function of the illuminance level.

NOTE The illuminance value is a relative value, ~~and is~~ not representing absolute lux values.

After receiver start-up, it can take the sensor some time before valid illuminance level measurements are obtained. During this time, "*inputValue*" shall be MASK. After the first valid illuminance level measurement is obtained, "*inputValue*" shall not be MASK, except in the case of physical sensor failure (see 9.6.1).

Examples of "*inputValue*" MASK values and highest valid values, for several values of "*resolution*":

– "*resolution*" = 4: "*inputValue*" is a 1-byte value
  - MASK is 0xFF, resulting in a QUERY INPUT VALUE reply of 0xFF.
  - For a valid illuminance level measurement, the highest possible measured value is 0xE, which results in the 1-byte "*inputValue*" of 0xEE.

– "*resolution*" = 9: "*inputValue*" is a 2-byte value
  - MASK is 0xFFFF, resulting in a QUERY INPUT VALUE reply of 0xFF and a QUERY INPUT VALUE LATCH reply of 0xFF.
  - For a valid illuminance level measurement, the highest possible measured value is 0x1FE, which results in the 2-byte "*inputValue*" of 0xFF7F.

– "*resolution*" = 18: "*inputValue*" is a 3-byte value
  - MASK is 0xFFFFFF, resulting in a QUERY INPUT VALUE reply of 0xFF and replies of 0xFF for each of the two QUERY INPUT VALUE LATCH commands sent after QUERY INPUT VALUE.
  - For a valid illuminance level measurement, the highest possible measured value is 0x3FFFE, which results in the 3-byte "*inputValue*" of 0xFFFFBF.

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9.4 Events

9.4.1 Priority use

9.4.1.1 General

The default *"eventPriority"* shall be priority 4. Since the application controller needs a timeslot to respond, "*eventPriority*" should not be set to 2.

9.4.1.2 Periodic events

The periodic "INPUT NOTIFICATION" message triggered by the report timer that reports the illumination level event shall always be sent with priority 5.

9.4.2 Bus usage

9.4.2.1 Instance level

Multiple events from an instance shall not be sent in a transaction. There is a configurable delay $T_{deadtime}$ that shall be taken into account. See 9.5.2 for more information.

9.4.2.2 Device level

At the device level, events from different instances may be sent in a transaction.

9.4.3 Encoding

Illuminance level events shall be encoded as shown in Table 1.

Table 1 – Illuminance level events

Event name	Event information	Description
illuminance level report	*illuminanceEvent*	An illuminance level report, passing the actual illuminance level along.

The event information shall be encoded as follows:

- if "*resolution*" ≤ 10: "*illuminanceEvent*" shall be encoded in such a way that the resulting event information is a 10-bit value, according to ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:~~ IEC 62386-103:2022, 9.8.2;
- in all other cases: "*illuminanceEvent*" shall provide the 10 MSB bits of the "*inputValue*".

9.4.4 Event configuration

~~The application controller may not need all the events mentioned in 9.4.1. The instance shall allow the application controller to set the *"eventFilter"* (see IEC 62386-103:2014 and IEC 62386-103:2014/AMD1: , 9.7.4) to inhibit those events that the application controller does not need. For this document, *"eventFilter"* shall be reduced to one byte.~~

Events shall be enabled or disabled according to the value of "*eventFilter*". For this document, "*eventFilter*" shall be reduced to one byte. No configuration of "*eventFilter*" shall prevent the periodic "INPUT NOTIFICATION" message triggered by the report timer (9.5.1).

NOTE Inhibiting events increases the effective bus bandwidth availability.

The *"eventFilter"* shall have the definition as given in Table 2:

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Table 2 – Event filter

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

The filter can be set via "SET EVENT FILTER (*DTR0*)" and be queried using "QUERY EVENT FILTER 0-7", see ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:~~ IEC 62386-103:2022 for details.

9.4.5 Event generation

The illuminance level event is a report of the ~~*"inputValue"*~~ measured value (see IEC 62386-103:2022, 9.8). In order to avoid flooding the system with too many events on small illuminance level changes, a hysteresis band is introduced. This hysteresis band is restricted by its upper ("*hysteresisBandHigh*") and lower ("*hysteresisBandLow*") boundaries. The height of the hysteresis band ("*hysteresisBand*"), has a direct impact on how sensitive the input device responds to changes of illuminance level and therefore event generation. The hysteresis band is not symmetrically arranged towards ~~*"inputValue"*~~ the measured value. Depending on the direction of the last change of ~~*"inputValue"*~~ measured value, the hysteresis band is spanned above or below ~~*"inputValue"*~~ the measured value.

The illuminance level event shall be generated

- each time ~~*"inputValue"*~~ the measured value becomes greater than "*hysteresisBandHigh*" or less than "*hysteresisBandLow*", or;
- after a timeout of T_{report} since the previous illuminance level report, irrespective of the actual ~~*"inputValue"*~~ measured value.

The power on values of "*hysteresisBandLow*" and "*hysteresisBandHigh*" are 0, such that the first non-zero value of ~~*"inputValue"*~~ the measured value shall cause the illuminance level event to be generated according to the first condition shown above. See 9.5.4 for details.

In case a new event occurs before the current event has been sent, the new event shall replace the current event. This could be caused, for example, by bus unavailability or the deadtime timer.

Each time the illuminance level event is sent because ~~*"inputValue"*~~ the measured value is outside of the range ["*hysteresisBandLow*", "*hysteresisBandHigh*"], then the values of "*hysteresisBandLow*" and "*hysteresisBandHigh*" shall be recalculated as follows:

- "*hysteresisBand*" is calculated as the maximum of:
  - "*hysteresis*" percentage of ~~*"inputValue"*~~ the measured value, and
  - "*hysteresisMin*"
- If ~~*"inputValue"*~~ the measured value is greater than "*hysteresisBandHigh*", then:
  - "*hysteresisBandHigh*" is set to ~~*"inputValue"*~~ the measured value, and
  - "*hysteresisBandLow*" is set to max (~~*"inputValue"*~~ measured value – "*hysteresisBand*",0)

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- If ~~"*inputValue*"~~ the measured value is less than "*hysteresisBandLow"*, then:
  - "*hysteresisBandLow"* is set to ~~"*inputValue*"~~ the measured value, and
  - "*hysteresisBandHigh"* is set to ~~"*inputValue*"~~ the measured value + "*hysteresisBand*"

NOTE It is possible for "*hysteresisBandHigh*" to exceed the maximum possible ~~"*inputValue*"~~ measured value in cases where ~~"*inputValue*"~~ the measured value is large and hysteresis is increased. Software developers can choose to limit "*hysteresisBandHigh*" to the maximum possible ~~"*inputValue*"~~ measured value.

Figure 2 shows an example of ~~"*inputValue*"~~ measured value changes, together with the resultant hysteresis bands (vertical lines) for the case where "*hysteresis*" is 10 % and "*hysteresisMin*" is 50. At measurements 1, 2, 4, 5, 6, 8 and 10, the illuminance level event is generated due to the new ~~"*inputValue*"~~ measured value being outside of the previously calculated range of ["*hysteresisBandLow*", "*hysteresisBandHigh*"]. Measurements 3, 7 and 9 do not generate the illuminance level event because the ~~"*inputValue*"~~ measured value is inside the previously calculated range of ["*hysteresisBandLow,* "*hysteresisBandHigh*"]. The initial values for "*hysteresisBandLow*" and "*hysteresisBandHigh*" are 0 due to power up of the device.

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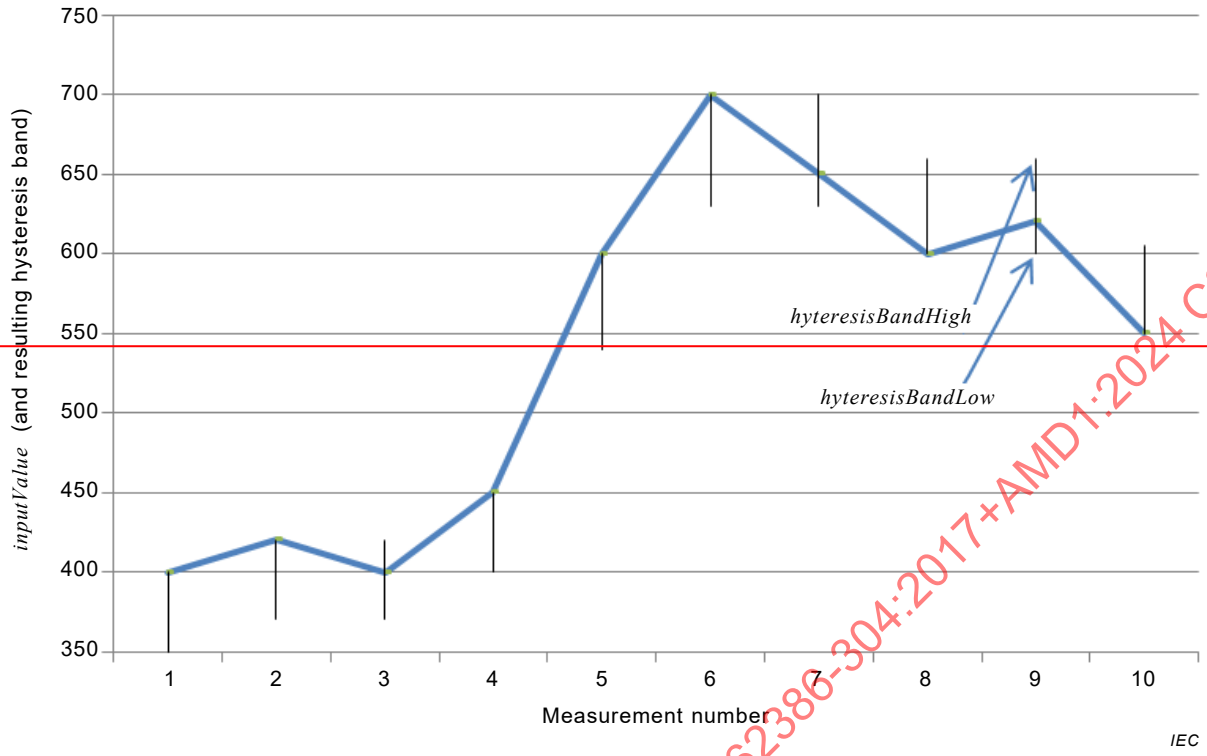

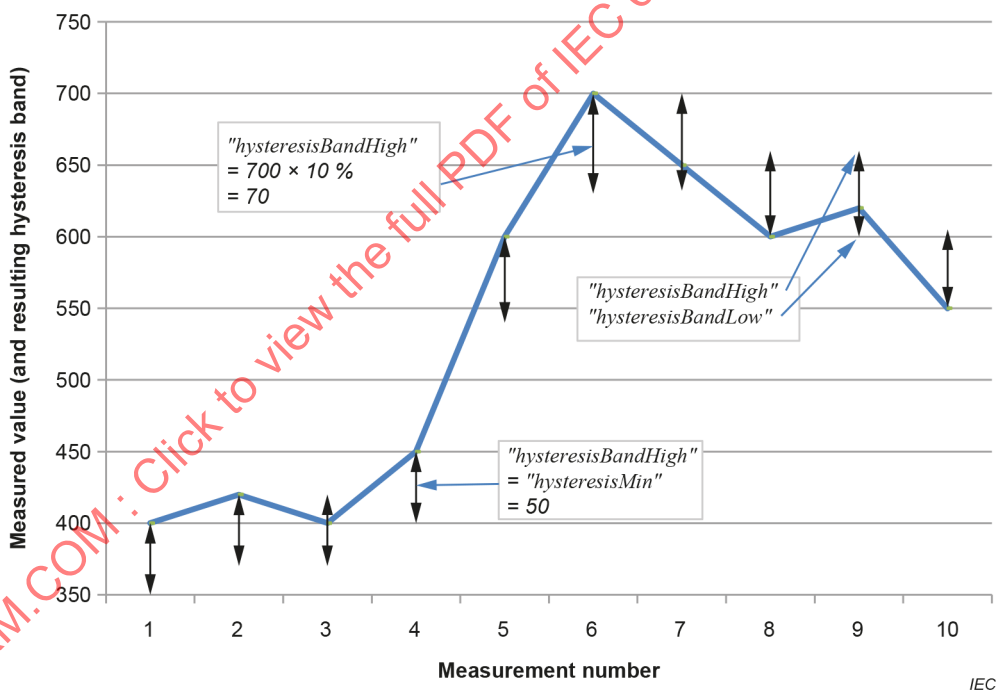

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Figure 2 – Example of ~~*inputValue*~~ measured value changes and resultant hysteresis bands

9.5 Configuring the input device

9.5.1 Using the report timer

If the report timer is set, it shall generate a ‘repeat’ trigger every T_{report} even if the “*inputValue*” has not changed. The report timer shall be restarted every time an event is sent.

The report timer shall be started,

- at power-on: if enabled, immediately after both the receiver has started up and the illuminance level measurement has become valid, with the time to the first trigger recommended to be shortened to a random time between 0 s and T_{report} s;
- otherwise immediately after enablement.

This implies that the first "INPUT NOTIFICATION" message due to the report timer is sent at a maximum time of T_{report} after starting. This may be delayed by other "INPUT NOTIFICATION" messages, or by bus availability.

NOTE If multiple devices have the report timer enabled, they might send out conflicting data ~~intended~~ used by application controllers to ~~affect~~ control the same control gear. ~~Depending on the application, care needs to be taken when enabling the report timer.~~ Application controllers can avoid this problem by enabling the report timer only when required.

9.5.2 Using the deadtime timer

If the deadtime timer is set, the instance shall not send out an event until the deadtime timer has expired. The deadtime timer shall be restarted every time an event is sent.

9.5.3 Setting the timers

The ~~event~~ deadtime and report timers shall be programmable as is indicated in Table 3.

For each timer, a fixed minimum duration and a fixed increment in duration are given. The application controller can set the desired actual timer duration by setting the number of increments to a value in the range [0,255]. The resulting time shall be strictly monotonic according to the following formula:

Time = T_{incr} * *multiplier*

Only on (re-)starting a timer the actual time shall be calculated based on the corresponding variable. This implies that the times only change after any running timer has been cancelled or expired. The tolerance on the time shall be ±5 %.

Table 3 – Event timer setting

Time	Multiplier	Default value	T_{incr}	$T_{default}$	T_{min}	T_{max}
$T_{deadtime}$	"*tDeadtime*"	30	50 ms	1,5 s	0 s	12,75 s
T_{report}	"*tReport*"	30	1 s	30 s	1 s	4 min 15 s

The input device shall expose the following operations to set and observe the timer multipliers:

- "SET REPORT TIMER (*DTR0*)", "QUERY REPORT TIMER" to set or query "*tReport*";
- "SET DEADTIME TIMER (*DTR0*)", "QUERY DEADTIME TIMER" to set or query "$t_{Deadtime}$".

"SET REPORT TIMER (*DTR0*)" shall set "*tReport*" depending on "*DTR0*". If "*tReport*" is set to 0, the report timer shall be disabled immediately.

"SET DEADTIME TIMER (*DTR0*)" shall set "*tDeadtime*" depending on "*DTR0*". If "*tDeadtime*" is set to 0, the deadtime timer shall be disabled immediately, but shall not affect T_{report} until the report timer is (re-)started.

If T_{report} < $T_{deadtime}$, T_{report} shall be $T_{deadtime}$ (independent of the value of "*tReport*").

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9.5.4 Setting the hysteresis

The height of the hysteresis band, "*hysteresisBand*", is calculated according to 9.4.5 using the percentage given by "*hysteresis*" with the minimum height given by "*hysteresisMin*". The input device shall support a hysteresis up to 25 %. A value of zero for *"hysteresis"* shall lead to illuminance level events based on T_{report} only. The lowest value in the hysteresis band is given by "*hysteresisBandLow*", and the highest value by "*hysteresisBandHigh*" – see 9.4.5. The input device shall expose the following operations to set and observe the values of "*hysteresis*" and "*hysteresisMin*":

- "SET HYSTERESIS (*DTR0*)", "QUERY HYSTERESIS" to set or query "*hysteresis*".

"SET HYSTERESIS (*DTR0*)" shall set "*hysteresis*" depending on the "*DTR0*" value as follows:

- if "*DTR0*" > 25: no change;
- in all other cases: "*DTR0*".

Since a hysteresis in percent would require a growing resolution in case the "*inputValue*" is low, the minimum value for the hysteresis is physically limited. To avoid unwanted events at low illumination levels, the minimum value for the hysteresis can also be set as an absolute value "*hysteresisMin*":

- "SET HYSTERESIS MIN (*DTR0*)", "QUERY HYSTERESIS MIN" to set or query "*hysteresisMin*".

"SET HYSTERESIS MIN (*DTR0*)" shall set "*hysteresisMin*" to "*DTR0"*.

NOTE After power-up, "*hysteresisBand*" can be greater than ("*hysteresisBandHigh*"-"*hysteresisBandLow*") until ~~"*inputValue*"~~ the measured value is greater than or equal to "*hysteresisMin*".

The default value for "*hysteresisMin*" shall depend on '*resolution*' as defined in Table 4.

Table 4 – Default and reset values for "*hysteresisMin*"

"*resolution*"	Factory default and reset value for "*hysteresisMin*"
1-6	0
7	1
8	2
9	5
10	10
11	20
12	40
13	81
14	163
>=15	255

NOTE The default value is approximately 1 %.

9.5.5 Manual configuration

If IEC 62386-333 is implemented, the instance level variables according to Table 5 may be manually configured. QUERY MANUAL CONFIGURATION CAPABILITY 3xx (see IEC 62386-333) shall return the byte as defined in Table 5:

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Table 5 – "*manualCapabilityInstance3xx*" values

Bit	Description	Value
0	Manual configuration of "*tReport*" supported	"1" = "Yes"
1	Manual configuration of "*tDeadtime*" supported	"1" = "Yes"
2	Manual configuration of "*hysteresis*" supported	"1" = "Yes"
3	Manual configuration of "*hysteresisMin*" supported	"1" = "Yes"
4	Reserved	"0"
5	Reserved	"0"
6	Reserved	"0"
7	Reserved	"0"

9.6 Exception handling

9.6.1 Physical sensor failure

If a physical sensor failure is detected, the instance shall set *"instanceError"* to TRUE, from the moment the failure is detected until the failure is resolved. While the error is detected, no further events shall be sent and "*inputValue*" shall be set to MASK as defined in 9.3.

9.6.2 Manufacturer specific errors

If a manufacturer specific error is detected, the instance shall set *"instanceError"* to TRUE, from the moment the error occurs until the error is gone.

9.6.3 Error value

"instanceError" can be observed via "QUERY INSTANCE STATUS".

While *"instanceError"* is set, "QUERY INSTANCE ERROR" shall return *"instanceErrorByte"* according to Table 6:

Table 6 – "*instanceErrorByte*" values

Bit	Description	Value
0	Physical sensor failure?	"1" = "Yes"
1	Reserved	"0"
2	Reserved	"0"
3	Reserved	"0"
4	Manufacturer specific error 1?	"1" = "Yes"
5	Manufacturer specific error 2?	"1" = "Yes"
6	Manufacturer specific error 3?	"1" = "Yes"
7	Manufacturer specific error 4?	"1" = "Yes"

If used, the meaning of bits [7:4] of "*instanceErrorByte*" shall be documented in the manual/documentation. The impact on event generation shall also be documented.

10 Declaration of variables

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, Clause 10 apply, with the following considerations.

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Table 7 shows additions to the device variables.

Table 7 – Declaration of device variables

Variable	Default value (factory)	Reset value	Power on value	Range of validity	Memory type
"*extendedVersionNumber*"	2.0	no change	no change	00001000b	ROM

Table 8 shows restrictions to the instance variables.

Table 8 – Restrictions to instance variables defined in ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022

Variable	Default value (factory)	Reset value	Power on value	Range of validity	Memory type
"*instanceType*"	4	no change	no change	4	ROM
"*eventFilter*"	1	1	no change	0000 000x [a]	NVM
"eventPriority"	4	4	no change	[2,5]	NVM
"*instanceConfiguration[x]*" [a]	reserved	reserved	reserved	reserved	reserved
[a] ~~The value should reflect the actual situation as soon as possible.~~ Where x is in the range [0,190].					

NOTE "*resolution*", "*inputValue*" and "*eventPriority*" are according to their respective definitions in ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022.

Table 9 shows additions to the instance variables.

Table 9 – Declaration of instance variables

Variable	Default value (factory)	Reset value	Power on value	Range of validity	Memory type
"*instanceErrorByte*"	[a]	no change	0[b]	~~xxxx 0000b~~ xxxx 000xb	RAM
"*hysteresisBand*"	[a]	no change	0	~~[0,max("inputValue")]~~ [0,$2^{"resolution"}$ – 2]	RAM
"*hysteresisBandHigh*"	[a]	no change	0	~~["*hysteresisBandLow*", max("inputValue")]~~ [*"hysteresisBandLow"*, $2^{"resolution"}$ – 2]	RAM
"*hysteresisBandLow*"	[a]	no change	0	[0, "*hysteresisBandHigh*"]	RAM
"*tReport*"	30	30	no change	[0,255]	NVM
"*tDeadtime*"	30	30	no change	[0,255]	NVM
"*hysteresisMin*"	See Table 4	See Table 4	no change	[0,255]	NVM
"*hysteresis*"	5	5	no change	[0,25]	NVM
[a] Not applicable. [b] The value should reflect the actual situation as soon as possible.					

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11 Definition of commands

11.1 General

Unused opcodes shall be reserved for future needs.

11.2 Overview sheets

11.2.1 General

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, 11.2 apply, with the following additions.

11.2.2 Standard commands

Table 10 gives an overview of the additional commands and queries.

Table 10 – Standard commands

Command name	Address byte	Instance byte	Opcode byte	DTR0	DTR1	DTR2	Answer	Send twice	See subclause	Command subclause
SET REPORT TIMER (*DTR0*)	Device	Instance	0x30	✓				✓	9.5.1	11.8.3
SET HYSTERESIS (*DTR0*)	Device	Instance	0x31	✓				✓	9.5.4	11.8.4
SET DEADTIME TIMER (*DTR0*)	Device	Instance	0x32	✓				✓	9.5.2	11.8.5
SET HYSTERESIS MIN (*DTR0*)	Device	Instance	0x33	✓				✓	9.5.4	11.8.6
QUERY HYSTERESIS MIN	Device	Instance	0x3C				✓		9.5.4	11.9.6
QUERY DEADTIME TIMER	Device	Instance	0x3D				✓		9.5.2	11.9.2
QUERY REPORT TIMER	Device	Instance	0x3E				✓		9.5.1	11.9.4
QUERY HYSTERESIS	Device	Instance	0x3F				✓		9.5.4	11.9.5

11.3 Event messages

11.3.1 INPUT NOTIFICATION (*device/instance, event*)

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, 11.3.1 apply, with the following addition:

Refer to 9.4.1 for an overview of *event* values.

11.3.2 POWER NOTIFICATION (*device*)

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, 11.3.2 apply.

11.4 Device control instructions

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, 11.4 apply.

11.5 Device configuration instructions

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, 11.5 apply.

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11.6 Device queries

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:~~ IEC 62386-103:2022, 11.6 apply.

11.7 Instance control instructions

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:~~ IEC 62386-103:2022, 11.7 apply.

11.8 Instance configuration instructions

11.8.1 General

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:~~ IEC 62386-103:2022, 11.8 apply, with the following additions and replacements:

11.8.2 SET EVENT FILTER (*DTR0*)

"eventFilter" shall be set to *DTR0* if the value is within the valid range. Otherwise, the command shall be ~~ignored~~ discarded.

11.8.3 SET REPORT TIMER (*DTR0*)

"*tReport*" shall be set to the "*DTR0*" value.

Refer to 9.5.1 for more information.

11.8.4 SET HYSTERESIS (*DTR0*)

"*hysteresis*" shall be set depending on the "*DTR0*" value as follows:

- if "*DTR0*" > 25: no change;
- in all other cases: "*DTR0*".

Refer to 9.4.5 and 9.5.4 for more information.

11.8.5 SET DEADTIME TIMER (*DTR0*)

"tDeadtime" shall be set to the "*DTR0*" value.

Refer to 9.5.2 for more information.

11.8.6 SET HYSTERESIS MIN (*DTR0*)

"hysteresisMin" shall be set to the "*DTR0*" value.

Refer to 9.4.5 and 9.5.4 for more information.

11.9 Instance queries

11.9.1 General

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:~~ IEC 62386-103:2022, 11.9 apply, with the following additions:

11.9.2 QUERY DEADTIME TIMER

The answer shall be *"tDeadtime"*.

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Refer to 9.5.2 for more information.

11.9.3 QUERY INSTANCE ERROR

The detailed error information shall be "*instanceErrorByte*".

Refer to 9.6.1 for more information.

11.9.4 QUERY REPORT TIMER

The answer shall be *"tReport"*.

Refer to 9.5.1 for more information.

11.9.5 QUERY HYSTERESIS

The answer shall be *"hysteresis"*.

Refer to 9.4.5 and 9.5.4 for more information.

11.9.6 QUERY HYSTERESIS MIN

The answer ~~shrall~~ shall be *"hysteresisMin"*.

Refer to 9.4.5 and 9.5.4 for more information.

11.10 Special commands

The requirements of ~~IEC 62386-103:2014 and IEC 62386-103:2014/AMD1:—~~ IEC 62386-103:2022, 11.10 apply.

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[1] IEC 61347 (all parts), *Lamp controlgear*

[2] IEC 61347-1, *Lamp controlgear – Part 1: General and safety requirements*

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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DIGITAL ADDRESSABLE LIGHTING INTERFACE –

Part 304: Particular requirements – Input devices – Light sensor

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62386-304 edition 1.1 contains the first edition (2017-05) [documents 34C/1314/FDIS and 34C/1334/RVD] and its amendment 1 (2024-04) [documents 34/1014/CDV and 34/1079A/RVC].

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

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International Standard IEC 62386-304 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Part 304 of IEC 62386 is intended to be used in conjunction with:

- Part 101, which contains general requirements for system components;
- Part 103, which contains general requirements for control devices.

A list of all parts in the IEC 62386 series, published under the general title: *Digital addressable lighting interface*, can be found on the IEC website.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The *'colour inside'* logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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INTRODUCTION

IEC 62386 contains several parts, referred to as series. The 1xx series includes the basic specifications. Part 101 contains general requirements for system components, Part 102 extends this information with general requirements for control gear and Part 103 extends it further with general requirements for control devices.

The 2xx parts extend the general requirements for control gear with lamp specific extensions (mainly for backward compatibility with Edition 1 of IEC 62386) and with control gear specific features.

The 3xx parts extend the general requirements for control devices with input device specific extensions describing the instance types as well as some common features that can be combined with multiple instance types.

This first edition of IEC 62386-304 is intended to be used in conjunction with IEC 62386-101:2022, IEC 62386-103:2022. The division of IEC 62386 into separately published parts provides for ease of future amendments and revisions. Additional requirements will be added as and when a need for them is recognized.

The setup of the standards is graphically represented in Figure 1 below.

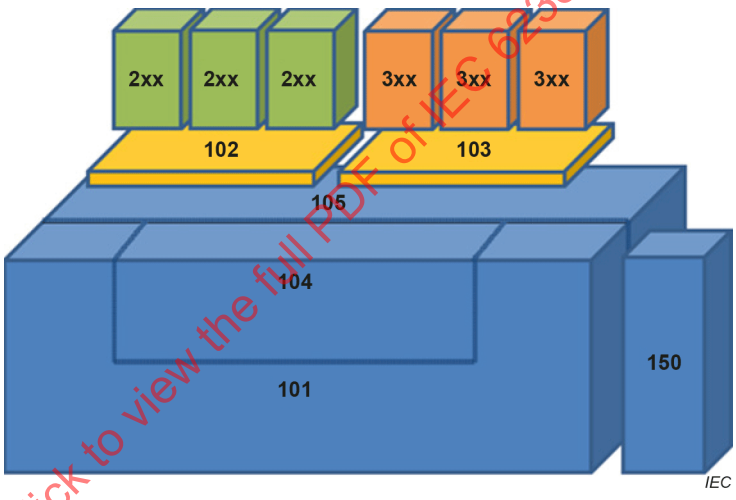

Figure 1 – IEC 62386 graphical overview

This document, and the other parts that make up the IEC 62386-300 series, in referring to any of the clauses of IEC 62386-1XX, specifies the extent to which such a clause is applicable and the order in which the tests are to be performed; the parts also include additional requirements, as necessary.

Where the requirements of any of the clauses of IEC 62386-1XX are referred to in this document by the sentence “The requirements of IEC 62386-1XX, Clause “n” apply”, this sentence is to be interpreted as meaning that all requirements of the clause in question of Part 1XX apply, except any which are clearly inapplicable.

The standardization of the control interface for control devices is intended to achieve compatible co-existence and multi-master operation between electronic control gear and lighting control devices, below the level of building management systems. This document describes a method of implementing light sensors.

All numbers used in this document are decimal numbers unless otherwise noted. Hexadecimal numbers are given in the format 0xVV, where VV is the value. Binary numbers are given in

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the format XXXXXXXXb or in the format XXXX XXXX, where X is 0 or 1; “x” in binary numbers means “don't care”.

The following typographic expressions are used:

Variables: *“variableName”* or *“variableName[3:0]”*, giving only bits 3 to 0 of *“variableName”*.

Time value is expressed in minutes and seconds: mm:ss

Range of values: [lowest, highest]

Command: “COMMAND NAME”

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DIGITAL ADDRESSABLE LIGHTING INTERFACE –

Part 304: Particular requirements – Input devices – Light sensor

1 Scope

This part of IEC 62386 is applicable to input devices that provide illuminance level information to the lighting control system through light level sensing.

This document is only applicable to input devices complying with IEC 62386-103:2022.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62386-101:2022, *Digital addressable lighting interface – Part 101: General requirements – System components*

IEC 62386-103:2022, *Digital addressable lighting interface – Part 103: General requirements – Control devices*

IEC 62386-333:2018, *Digital addressable lighting interface – Part 333: Particular requirements for control devices – Manual configuration (feature type 33)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62386-101 and IEC 62386-103 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
instance
illuminance level input signal processing unit of an input device

[SOURCE: IEC 62386-101:2022, 3.29, modified — addition of "illuminance level input"]

3.2
strictly monotonic
either entirely increasing or decreasing without repeating values

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4 General

4.1 General

The requirements of IEC 62386-103:2022, Clause 4 apply, with the restrictions, changes and additions identified below.

4.2 Version number

In 4.2 of IEC 62386-103:2022, “103” shall be replaced by “304”, “version number” shall be replaced by “extended version number” and “*versionNumber*” shall be replaced by "*extendedVersionNumber*".

4.3 Insulation

According to applicable safety standards, it can be required that the input device has at least supplementary insulation to accessible parts. This depends on the connected components. In this case special attention should be paid with respect to the sensor(s) being used.

NOTE IEC 62386-103:2022 requires system components to have at least basic insulation.

5 Electrical specification

The requirements of IEC 62386-103:2022, Clause 5 apply.

6 Interface power supply

The requirements of IEC 62386-103:2022, Clause 6 apply.

7 Transmission protocol structure

The requirements of IEC 62386-103:2022, Clause 7 apply.

NOTE Subclause 9.4 provides detailed event information applicable to instances.

8 Timing

The requirements of IEC 62386-103:2022, Clause 8 apply.

9 Method of operation

9.1 General

The requirements of IEC 62386-103:2022, Clause 9 apply, with the following restrictions and additions.

9.2 Instance type

The instance type (*“instanceType”*) shall be equal to 4.

9.3 Input signal and value

The measured value shall contain the measured illuminance with a precision of "*resolution*" bits and shall be encoded in "*inputValue*" as described in IEC 62386-103:2022, 9.8.2. The measured value shall be a strictly monotonic function of the illuminance level.

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NOTE The illuminance value is a relative value, not representing absolute lux values.

After receiver start-up, it can take the sensor some time before valid illuminance level measurements are obtained. During this time, "*inputValue*" shall be MASK. After the first valid illuminance level measurement is obtained, "*inputValue*" shall not be MASK, except in the case of physical sensor failure (see 9.6.1).

Examples of "*inputValue*" MASK values and highest valid values, for several values of "*resolution*":

– "*resolution*" = 4: "*inputValue*" is a 1-byte value
  - MASK is 0xFF, resulting in a QUERY INPUT VALUE reply of 0xFF.
  - For a valid illuminance level measurement, the highest possible measured value is 0xE, which results in the 1-byte "*inputValue*" of 0xEE.
– "*resolution*" = 9: "*inputValue*" is a 2-byte value
  - MASK is 0xFFFF, resulting in a QUERY INPUT VALUE reply of 0xFF and a QUERY INPUT VALUE LATCH reply of 0xFF.
  - For a valid illuminance level measurement, the highest possible measured value is 0x1FE, which results in the 2-byte "*inputValue*" of 0xFF7F.
– "*resolution*" = 18: "*inputValue*" is a 3-byte value
  - MASK is 0xFFFFFF, resulting in a QUERY INPUT VALUE reply of 0xFF and replies of 0xFF for each of the two QUERY INPUT VALUE LATCH commands sent after QUERY INPUT VALUE.
  - For a valid illuminance level measurement, the highest possible measured value is 0x3FFFE, which results in the 3-byte "*inputValue*" of 0xFFFFBF.

9.4 Events

9.4.1 Priority use

9.4.1.1 General

The default *"eventPriority"* shall be priority 4. Since the application controller needs a timeslot to respond, "*eventPriority*" should not be set to 2.

9.4.1.2 Periodic events

The periodic "INPUT NOTIFICATION" message triggered by the report timer that reports the illumination level event shall always be sent with priority 5.

9.4.2 Bus usage

9.4.2.1 Instance level

Multiple events from an instance shall not be sent in a transaction. There is a configurable delay $T_{deadtime}$ that shall be taken into account. See 9.5.2 for more information.

9.4.2.2 Device level

At the device level, events from different instances may be sent in a transaction.

9.4.3 Encoding

Illuminance level events shall be encoded as shown in Table 1.

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Table 1 – Illuminance level events

Event name	Event information	Description
illuminance level report	*illuminanceEvent*	An illuminance level report, passing the actual illuminance level along.

The event information shall be encoded as follows:

- if "*resolution*" ≤ 10: "*illuminanceEvent*" shall be encoded in such a way that the resulting event information is a 10-bit value, according to IEC 62386-103:2022, 9.8.2;
- in all other cases: "*illuminanceEvent*" shall provide the 10 MSB bits of the "*inputValue*".

9.4.4 Event configuration

Events shall be enabled or disabled according to the value of "*eventFilter*". For this document, "*eventFilter*" shall be reduced to one byte. No configuration of "*eventFilter*" shall prevent the periodic "INPUT NOTIFICATION" message triggered by the report timer (9.5.1).

NOTE Inhibiting events increases the effective bus bandwidth availability.

The *"eventFilter"* shall have the definition as given in Table 2:

Table 2 – Event filter

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

The filter can be set via "SET EVENT FILTER (*DTR0*)" and be queried using "QUERY EVENT FILTER 0-7", see IEC 62386-103:2022 for details.

9.4.5 Event generation

The illuminance level event is a report of the measured value (see IEC 62386-103:2022, 9.8). In order to avoid flooding the system with too many events on small illuminance level changes, a hysteresis band is introduced. This hysteresis band is restricted by its upper ("*hysteresisBandHigh*") and lower ("*hysteresisBandLow*") boundaries. The height of the hysteresis band ("*hysteresisBand*"), has a direct impact on how sensitive the input device responds to changes of illuminance level and therefore event generation. The hysteresis band is not symmetrically arranged towards the measured value. Depending on the direction of the last change of measured value, the hysteresis band is spanned above or below the measured value.

The illuminance level event shall be generated

- each time the measured value becomes greater than "*hysteresisBandHigh*" or less than "*hysteresisBandLow*", or;

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- after a timeout of T_{report} since the previous illuminance level report, irrespective of the actual measured value.

The power on values of "*hysteresisBandLow*" and "*hysteresisBandHigh*" are 0, such that the first non-zero value of the measured value shall cause the illuminance level event to be generated according to the first condition shown above. See 9.5.4 for details.

In case a new event occurs before the current event has been sent, the new event shall replace the current event. This could be caused, for example, by bus unavailability or the deadtime timer.

Each time the illuminance level event is sent because the measured value is outside of the range ["*hysteresisBandLow*", "*hysteresisBandHigh*"], then the values of "*hysteresisBandLow*" and "*hysteresisBandHigh*" shall be recalculated as follows:

- "*hysteresisBand*" is calculated as the maximum of:
  - "*hysteresis*" percentage of the measured value, and
  - "*hysteresisMin*"
- If the measured value is greater than "*hysteresisBandHigh*", then:
  - "*hysteresisBandHigh*" is set to the measured value, and
  - "*hysteresisBandLow*" is set to max (measured value – "*hysteresisBand*",0)
- If the measured value is less than "*hysteresisBandLow*", then:
  - "*hysteresisBandLow*" is set to the measured value, and
  - "*hysteresisBandHigh*" is set to the measured value + "*hysteresisBand*"

NOTE It is possible for "*hysteresisBandHigh*" to exceed the maximum possible measured value in cases where the measured value is large and hysteresis is increased. Software developers can choose to limit "*hysteresisBandHigh*" to the maximum possible measured value.

Figure 2 shows an example of measured value changes, together with the resultant hysteresis bands (vertical lines) for the case where "*hysteresis*" is 10 % and "*hysteresisMin*" is 50. At measurements 1, 2, 4, 5, 6, 8 and 10, the illuminance level event is generated due to the new measured value being outside of the previously calculated range of ["*hysteresisBandLow*", "*hysteresisBandHigh*"]. Measurements 3, 7 and 9 do not generate the illuminance level event because the measured value is inside the previously calculated range of ["*hysteresisBandLow,* "*hysteresisBandHigh*"]. The initial values for "*hysteresisBandLow*" and "*hysteresisBandHigh*" are 0 due to power up of the device.

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