IEC 62386-305

Edition 1.0 2023-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Digital addressable lighting interface – Part 305: Particular requirements – Input devices – Colour sensor

Interface d'éclairage adressable numérique – Partie 305: Exigences particulières – Dispositifs d'entrée – Capteur de couleur

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colour inside

Digital addressable lighting interface – Part 305: Particular requirements – Input devices – Colour sensor

Interface d'éclairage adressable numérique – Partie 305: Exigences particulières – Dispositifs d'entrée – Capteur de couleur

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CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope 8
2 Normative references 8
3 Terms and definitions 8
4 General 9
4.1 General requirements 9
4.2 Version number 9
4.3 Insulation 9
5 Electrical specification 9
6 Bus power supply 9
7 Transmission protocol structure 9
8 Timing 9
9 Method of operation 9
9.1 General 9
9.2 Instance type 9
9.3 Input signal and value 10
9.3.1 General 10
9.3.2 Input value encoding 10
9.4 Events 10
9.4.1 Priority use 10
9.4.2 Bus usage 10
9.4.3 Encoding 10
9.4.4 Event configuration 11
9.4.5 Event generation 12
9.5 Configuring the input device 12
9.5.1 Using the report timer 12
9.5.2 Using the deadtime timer 13
9.5.3 Setting the timers 13
9.5.4 Setting the hysteresis 14
9.5.5 Manual configuration 14
9.6 Exception handling 14
9.6.1 Physical sensor failure 14
9.6.2 Manufacturer-specific errors 14
9.6.3 Error value 15
10 Declaration of variables 15
11 Definition of commands 16
11.1 General 16
11.2 Overview sheets 16
11.2.1 General 16
11.2.2 Standard commands 17
11.3 Event messages 17
11.3.1 INPUT NOTIFICATION (*device/instance, event*) 17
11.3.2 POWER NOTIFICATION (*device*) 17
11.4 Device control instructions 17
11.5 Device configuration instructions 17

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Document Sharing Hub

11.6 Device queries ... 17
11.7 Instance control instructions ... 17
11.8 Instance configuration instructions ... 17
11.8.1 General ... 17
11.8.2 SET EVENT FILTER (*DTR0*) ... 18
11.8.3 SET REPORT TIMER (*DTR0*) ... 18
11.8.4 SET HYSTERESIS (*DTR0*) ... 18
11.8.5 SET DEADTIME TIMER (*DTR0*) ... 18
11.8.6 SET HYSTERESIS MIN (*DTR0*) ... 18
11.9 Instance queries ... 18
11.9.1 General ... 18
11.9.2 QUERY COLOUR SENSOR (*DTR0*) ... 18
11.9.3 QUERY DEADTIME TIMER ... 19
11.9.4 QUERY INSTANCE ERROR ... 19
11.9.5 QUERY REPORT TIMER ... 19
11.9.6 QUERY HYSTERESIS ... 20
11.9.7 QUERY HYSTERESIS MIN ... 20
11.10 Special commands ... 20
Annex A (informative) Explanation of radiometric parameters of colour sensors ... 21
Bibliography ... 23

Figure 1 – IEC 62386 graphical overview ... 6
Figure A.1 – Example sensor sensitivity ... 21

Table 1 – Input value encoding ... 10
Table 2 – Colour value events ... 11
Table 3 – Colour report ... 11
Table 4 – Event filter ... 11
Table 5 – Event timer setting ... 13
Table 6 – *"manualCapabilityInstance3xx"* values ... 14
Table 7 – *"instanceErrorByte"* values ... 15
Table 8 – Declaration of device variables ... 15
Table 9 – Restrictions to instance variables defined in IEC 62386-103:2022 ... 16
Table 10 – Declaration of instance variables ... 16
Table 11 – Standard commands ... 17
Table 12 – DTR reference ... 19
Table A.1 – Example answers to QUERY COLOUR SENSOR (*DTR0*) ... 22

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DIGITAL ADDRESSABLE LIGHTING INTERFACE –

Part 305: Particular requirements – Input devices – Colour sensor

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The text of this International Standard is based on the following documents:

Draft	Report on voting
34/1065/FDIS	34/1080/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

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This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This document is intended to be used in conjunction with:

- IEC 62386-101, which contains general requirements for system components;
- IEC 62386-103, 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 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

The IEC 62386 series specifies a bus system for control by digital signals of electronic lighting equipment and contains several parts, referred to as series. The IEC 62386-1xx series includes the basic specifications. IEC 62386-101 contains general requirements for system components, IEC 62386-102 extends this information with general requirements for control gear and IEC 62386-103 extends it further with general requirements for control devices. IEC 62386-104 and IEC 62386-105 can be applied to control gear or control devices. IEC 62386-104 gives requirements for wireless and alternative wired system components. IEC 62386-105 describes firmware transfer. IEC 62386-150 gives requirements for an auxiliary power supply which can be stand-alone, or built into control gear or control devices.

The IEC 62386-2xx series extends 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 IEC 62386-3xx series extends 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 62386-305 is intended to be used in conjunction with IEC 62386-101, and IEC 62386-103. The division 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.

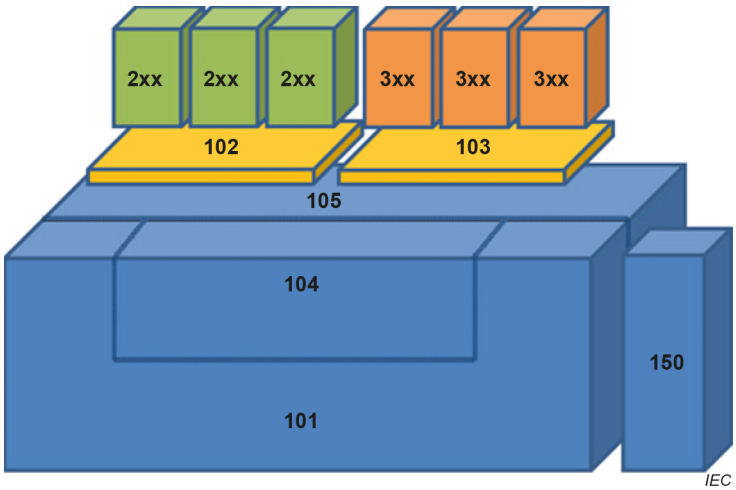

Figure 1 – IEC 62386 graphical overview

When this part of IEC 62386 refers to any of the clauses of the IEC 62386-1xx series, the extent to which such a clause is applicable is specified. The other parts also include additional requirements, as necessary.

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".

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The following typographic expressions are used:

Variables: *"variableName"* or *"variableName[3:0]"*, giving only bits 3 to 0 of *"variableName"*;

Range of values: [lowest, highest];

Command: "COMMAND NAME".

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DIGITAL ADDRESSABLE LIGHTING INTERFACE –

Part 305: Particular requirements – Input devices – Colour sensor

1 Scope

This part of IEC 62386 is applicable to input devices that provide the lighting control system with colour information by colour sensing.

This document is only applicable to IEC 62386-103 input devices that deliver colour information to the lighting control system through colour sensing.

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, *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 terminology databases for use in standardization at the following addresses:

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

3.1
instance
observed colour signal processing unit of an input device

[SOURCE: IEC 62386-101:2022, 3.29, modified – Addition of "observed colour".]

3.2
strictly monotonic
either entirely increasing or decreasing without repeating values

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3.3
observed colour
colour as detected by physical sensor on input device

4 General

4.1 General requirements

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

4.2 Version number

In IEC 62386-103:2022, 4.2, "103" shall be replaced by "305", "version number" shall be replaced by "extended version number" and *"versionNumber"* shall be replaced by *"extendedVersionNumber"*.

4.3 Insulation

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

NOTE IEC 62386-101:2022 requires the interface of system components to have at least basic insulation.

5 Electrical specification

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

6 Bus 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 5, indicating a colour sensor.

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9.3 Input signal and value

9.3.1 General

The *"inputValue"* shall indicate the value measured by the sensor, encoded as a 24-bit red-green-blue (RGB) value. The red, green and blue components of *"inputValue"* shall be a strictly monotonic function of the corresponding measured red, green and blue values.

After receiver start-up, it can take the sensor some time before valid colour measurements are obtained. During this time, QUERY INPUT VALUE and QUERY INPUT VALUE LATCH shall reply as if *"inputValue"* is MASK. After the first valid colour measurement is obtained, *"inputValue"* shall not be MASK, except in the case of physical sensor failure (see 9.6.1).

The input *"resolution"* shall be equal to 24.

NOTE A *"resolution"* of 24 implies that *"inputValue"* is a three-byte value.

9.3.2 Input value encoding

The *"inputValue"* shall be encoded as shown in Table 1.

Table 1 – Input value encoding

Bits	Description	Value	Alias
[7:0]	Red	Observed red level [0, 254]	*"rValue"*
[15:8]	Green	Observed green level [0, 254]	*"gValue"*
[23:16]	Blue	Observed blue level [0, 254]	*"bValue"*

9.4 Events

9.4.1 Priority use

9.4.1.1 General

The default *"eventPriority"* is defined in Table 9.

NOTE Application controllers can ensure this instance leaves higher priority timeslots on the bus by setting the instance's *"eventPriority"* to a priority greater than 2.

9.4.1.2 Periodic events

The periodic "INPUT NOTIFICATION" message triggered by the report timer that reports the colour value 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 the same transaction. Also, 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

Colour value events shall be encoded as shown in Table 2.

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Table 2 – Colour value events

Event name	Event information	Description
Colour report	*"colourEvent"*	A colour value report, passing a truncated RGB value.

The *"colourEvent"* information shall be encoded as shown in Table 3.

Table 3 – Colour report

"colourEvent" bits	Description	Value
[2:0]	Red	*"inputValue"*[7:5] (3 most significant bits of red)
[5:3]	Green	*"inputValue"*[15:13] (3 most significant bits of green)
[8:6]	Blue	*"inputValue"*[23:21] (3 most significant bits of blue)
[9]	Unused	0

NOTE 1 Due to the 10-bit size of the event message information, the resulting colour report provides only 512 colour combinations and depending on the set-point of the hysteresis, duplicate event messages are possible.

NOTE 2 Application controllers can query the *"inputValue"* to obtain a higher resolution representation of the measurement.

9.4.4 Event configuration

Events shall be enabled or disabled according to the value of *"eventFilter"*, as specified in Table 4. For this instance type, *"eventFilter"* shall be reduced to one byte. No configurations 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.

Table 4 – Event filter

Bit	Description	Value	Default
0	Colour report 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 event filter can be set via "SET EVENT FILTER (*DTR0*)" and queried using "QUERY EVENT FILTER 0-7", see IEC 62386-103:2022 for details.

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9.4.5 Event generation

The colour report event is a truncated report of the *"inputValue"*. To limit the number of events generated on small level changes, a hysteresis band is introduced. The height of the hysteresis band (*"hysteresisBand"*) determines the minimum change of the colour values that shall generate an event according to the following calculations. As the *"inputValue"* is an array of the three colour values, *"rValue"*, *"gValue"* and *"bValue"*, the hysteresis is based on the summed absolute change of each colour value.

$$"absoluteChange" = |"rValue" - "rLast"| + |"gValue" - "gLast"| + |"bValue" - "bLast"|$$

The colour report event shall be generated

- each time *"absoluteChange"* becomes greater than *"hysteresisBand"*, or
- after a timeout of T_{report} since the previous colour event, irrespective of the actual *"inputValue"*.

The power on value of *"hysteresisBand"* is 0, such that the first non-zero value of *"inputValue"* shall cause the colour report 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 can be caused, for example, by bus unavailability or the deadtime timer.

Each time the colour report event is sent because *"absoluteChange"* is greater than *"hysteresisBand"*, then the values of *"rLast"*, *"gLast"*, *"bLast"* and *"hysteresisBand"* shall be recalculated as follows:

- *"hysteresisBand"* is calculated as the maximum of:
  - *"hysteresis"* percentage of (*"rValue"* + *"gValue"* + *"bValue"*), and
  - *"hysteresisMin"*;
- *"rLast"* = *"rValue"*;
- *"gLast"* = *"gValue"*;
- *"bLast"* = *"bValue"*.

EXAMPLE with *"hysteresis"* of 10 %:

At power-on, *"hysteresisBand"* is 0. Measurement 1 gives colour values of [R = 70, G = 110, B = 120]. A colour report event is generated as *"absoluteChange"* > *"hysteresisBand"*. *"hysteresisBand"* is set to 30 ((70 + 110 + 120) × 10 %). *"rLast"* = 70, *"gLast"* = 110, *"bLast"* = 120.

Measurement 2 gives colour values of [R = 80, G = 106, B = 125]. *"absoluteChange"* = |80 − 70| + |106 − 110| + |125 − 120| = 19. A colour report event is not generated as *"absoluteChange"* ≤ *"hysteresisBand"*. *"hysteresisBand"*, *"rLast"*, *"gLast"* and *"bLast"* are unchanged.

Measurement 3 gives colour values of [R = 85, G = 98, B = 130]. *"absoluteChange"* = |85 − 70| + |98 − 110| + |130 − 120| = 37. A colour report event is generated as *"absoluteChange"* > *"hysteresisBand"*. *"hysteresisBand"* is set to 31 ((85 + 98 + 130) × 10 %). *"rLast"* = 85, *"gLast"* = 98, *"bLast"* = 130.

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.

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The report timer shall be started,

- at power-on: if enabled, immediately after both the receiver has started up and the colour 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.

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 deadtime and report timers shall be programmable as indicated in Table 5.

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 = $T_{\text{incr}} \cdot multiplier$

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 5 – 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	5 s	2 min 30 s	5 s	21 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 *"tDeadtime"*.

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

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