INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Digital addressable lighting interface –
Part 205: Particular requirements for control gear – Supply voltage controller for incandescent lamps (device type 4)**

**Interface d'éclairage adressable numérique –
Partie 205: Exigences particulières pour les appareillages de commande – Variateur de tension d'alimentation pour les lampes à incandescence (dispositifs de type 4)**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION
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DIGITAL ADDRESSABLE LIGHTING INTERFACE –

**Part 205: Particular requirements for control gear –
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(device type 4)**

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International Standard IEC 62386-205 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment.

The text of this standard is based on the following documents:

CDV	Report on voting
34C/819/CDV	34C/840/RVC

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

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

This Part 205 is intended to be used in conjunction with IEC 62386-101 and IEC 62386-102, which contain general requirements for the relevant product type (control gear or control devices).

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC website under http://webstore.iec.ch in the data related to the specific publication. At this date, the publication will be

• reconfirmed;
• withdrawn;
• replaced by a revised edition, or
• amended.

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INTRODUCTION

This first edition of IEC 62386-205 is published in conjunction with IEC 62386-101 and IEC 62386-102. 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.

This International Standard, and the other parts that make up the IEC 62386-200 series, in referring to any of the clauses of IEC 62386-101 or IEC 62386-102, specify 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. All parts that make up the IEC 62386-200 series are self-contained and therefore do not include references to each other.

Where the requirements of any of the clauses of IEC 62386-101 or IEC 62386-102 are referred to in this International Standard 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 101 or Part 102 apply, except any which are inapplicable to the specific type of lamp control gear covered by Part 205.

All numbers used in this International Standard 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".

DIGITAL ADDRESSABLE LIGHTING INTERFACE –

**Part 205: Particular requirements for control gear –
Supply voltage controller for incandescent lamps
(device type 4)**

1   Scope

This International Standard specifies a protocol and test procedures for the control by digital signals of electronic control gear associated with incandescent lamps.

2   Normative references

The following referenced documents are indispensable for the application 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 62386-101:2009, *Digital addressable lighting interface – Part 101: General requirements – System*

IEC 62386-102:2009, *Digital addressable lighting interface – Part 102: General requirements – Control gear*

3   Terms and definitions

For the purposes of this document, the terms and definitions given in Clause 3 of IEC 62386-101:2009 and Clause 3 of IEC 62386-102:2009 apply, together with the following.

**3.1
reference measurement**
measurement of the actual lamp load

NOTE   Control gear determines the actual lamp load with internal procedures and measurements, not specified by this standard.

**3.2
detection of load decrease**
recognition that the actual lamp load is significantly below the load measured during a successful 'reference measurement'

NOTE   The criteria for regarding a load increase or decrease as significant can only be defined by the manufacturer, and these criteria should be described in the manual.

**3.3
detection of load increase**
recognition that the actual lamp load is significantly above the load measured during a successful 'reference measurement'

NOTE   The criteria for regarding a load increase or decrease as significant can only be defined by the manufacturer, and these criteria should be described in the manual.

**3.4
thermal overload**
the maximum permissible gear temperature is exceeded

3.5
thermal shut down
gear switches off the lamp because automatic reduction of output level failed to prevent a persistent thermal overload

3.6
light level reduction due to thermal overload
light level reduction with the objective of decreasing gear temperature.

3.7
load over-current shutdown
gear switches off the lamp because automatic reduction of output level failed to prevent a persistent over-current condition.

4 General description

The requirements of Clause 4 of IEC 62386-101:2009 and Clause 4 of IEC 62386-102:2009 shall apply.

5 Electrical specifications

The requirements of Clause 5 of IEC 62386-101:2009 and Clause 5 of IEC 62386-102:2009 shall apply.

6 Interface power supply

The requirements of Clause 6 of IEC 62386-101:2009 and Clause 6 of IEC 62386-102:2009 shall apply if a power supply is integrated with the control gear.

7 Transmission protocol structure

The requirements of Clause 7 of IEC 62386-101:2009 and Clause 7 of IEC 62386-102:2009 shall apply.

8 Timing

The requirements of Clause 8 of IEC 62386-101:2009 and Clause 8 of IEC 62386-102:2009 shall apply.

9 Method of operation

9.1 General

The requirements of Clause 9 of IEC 62386-101:2009 and Clause 9 of IEC 62386-102:2009 shall apply with the following additions and adaptations:

The dimming curve, whether logarithmic or linear, shall apply for a lamp type and rating suitable for the use by the control gear.

The dimming mode in the case of a fixed-mode universal dimmer shall only be changeable by the means of a switch or other physical controls on the dimmer, and not from the interface.

NOTE   This eliminates the danger of unintentional changes during system programming.

9.2   Detection of load decrease

If the actual lamp load is significantly below the load measured during a successful 'reference measurement', the control gear might switch off the lamp if this is necessary for its safe operation and the flag bit 'load decrease' shall be set.

9.3   Detection of load increase

If the actual lamp load is significantly above the load measured during a successful 'reference measurement', the control gear might switch off if this is necessary for its safe operation and the flag bit 'load increase' shall be set.

9.4   Lamp replacement on control gear with load increase/decrease feature

If a lamp is replaced with one of a different power, the control gear may falsely detect load decrease or load increase. In this case, correct detection of load decrease or load increase shall require a successful 'REFERENCE SYSTEM POWER' measurement.

NOTE In some cases, replacement of a lamp with one of the same power may require a new 'REFERENCE SYSTEM MEASUREMENT' for correct detection of load decrease or load increase.

10   Declaration of variables

The requirements of Clause 10 of IEC 62386-101:2009 and Clause 10 of IEC 62386-102:2009 shall apply, with the following additional variables for this device type, indicated in Table 1.

Table 1 – Declaration of variables

Variable	Default value	Reset value	Range of validity	Memory [a]
"DIMMING CURVE"	0	No change	0 – 1 (2 – 255 reserved)	1 byte
"DIMMER STATUS"	0000 00UU [b]	No change except bit 4 is reset to 0	0 - 255	1 byte RAM [c]
"DIMMER FEATURES"	Factory burn-in	No change	0 - 255 each byte	3 bytes ROM
"FAILURE STATUS BYTE 1"	UUU0 UUUU [b]	No change	0 - 255	1 byte RAM [c]
"FAILURE STATUS BYTE 2"	000U UUUU [b]	No change	0 - 255	1 byte RAM
"DIMMER TEMPERATURE"	UUUU UUUU [b]	No change	0 – 254, 255 ('Mask')	1 byte RAM
"RMS SUPPLY VOLTAGE"	UUUU UUUU [b]	No change	0 – 254, 255 ('Mask')	1 byte RAM
"SUPPLY FREQUENCY"	UUUU UUUU [b]	No change	0 – 254, 255 ('Mask')	1 byte RAM
"RMS LOAD VOLTAGE"	UUUU UUUU [b]	No change	0 – 254, 255 ('Mask')	1 byte RAM
"RMS LOAD CURRENT"	UUUU UUUU [b]	No change	0 – 254, 255 ('Mask')	1 byte RAM
"REAL LOAD POWER"	UUUU UUUU [b]	No change	0 – 65534, 65535 ('Mask')	2 bytes RAM
"LOAD RATING"	Factory burn-in	No change	0 – 254, 255 ('Mask')	1 byte ROM
"DEVICE TYPE"	4	No change	0 - 254	1 byte ROM
"EXTENDED VERSION NUMBER"	1	No change	0 - 255	1 byte ROM

U = undefined

[a] Persistent memory (storage time indefinite) if not stated otherwise

[b] Power up value, except bit 7 of "FAILURE STATUS BYTE 1" and bit 4 of "DIMMER STATUS"

[c] Bit 7 of "FAILURE STATUS BYTE 1" and Bit 4 of "DIMMER STATUS" shall be stored in persistent memory.

11 Definition of commands

The requirements of Clause 11 of IEC 62386-101:2009 and Clause 11 of IEC 62386-102:2009 shall apply, with the following exceptions:

Amendment of Clause 11 of IEC 62386-102:2009:

11.3.1 Queries related to status information

Amendment:

Command 144:   **YAAA AAA1 1001 0000**   **"QUERY STATUS"**

The definition shall be as given in IEC 62386-102:2009, with the exception of the following optional extra meaning to bit 0:

bit 0   Status of control gear;   "0" = OK

"1" means thermal problem, supply problem or control gear not OK. "0" does not necessarily imply that there is no thermal problem or supply problem.

Command 146:   **YAAA AAA1 1001 0010**   **"QUERY LAMP FAILURE"**

The answer shall be as described in IEC 62386-102:2009, with the following meaning:

"Yes" = one of the following:

– open circuit;

– load increase;

– load decrease;

– load over-current shut down;

– load current overload with light level reduction;

– load voltage out of limits;

– load not suitable for selected dimming method.

"No" does not necessarily imply that no lamps have failed.

Command 153:   **YAAA AAA1 1001 1001**   **"QUERY DEVICE TYPE"**

The answer shall be 4.

11.3.4 Application extended commands

Replacement:

Application extended commands shall be preceded by command 272 'ENABLE DEVICE TYPE 4'. Dimmer types of control gear shall not react to application extended commands preceded by command 272 'ENABLE DEVICE TYPE X' with X ≠ 4.

NOTE   For other device types, these commands may be used in a different way.

11.3.4.1 Application extended configuration commands

Every configuration command (224 – 225) shall be received a second time within 100 ms (nominal) before it is executed in order to reduce the probability of incorrect reception. No other commands addressing the same control gear shall be sent between these two

commands, otherwise the first such command shall be ignored and the respective configuration sequence aborted.

Command 272 should be sent before the two instances of the respective control command, but not repeated between them (see Figure 1).
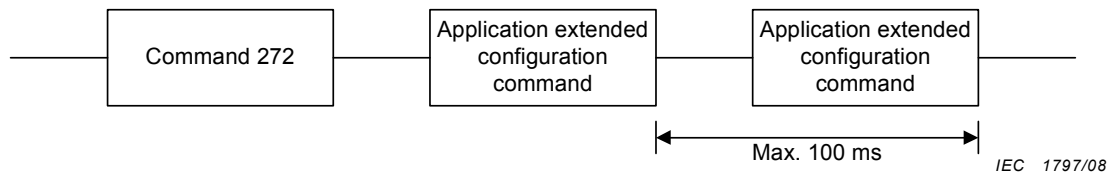

IEC   1797/08

Figure 1 – Application extended configuration command sequence example

Command 224:   YAAA AAA1 1110 0000   "REFERENCE SYSTEM POWER"

The control gear shall measure and store system power levels in order to detect load increase or load decrease.

NOTE The number of system power levels is optional; it is up to the manufacturer to decide upon the number each type of control gear should measure.

The measured power levels shall be stored in the persistent memory. Commands received during the measuring period shall be ignored except query commands and command 256.

After 15 min at most, the control gear shall finish the measurement process and shall go back to normal operation. The measurement process shall be aborted if command 256 'TERMINATE' is received.

Command 225:   YAAA AAA1 1110 0001   "SELECT DIMMING CURVE"

The dimming curve of the control gear shall be set according to the value of DTR.

DTR = 0 sets the dimming curve to the standard logarithmic output characteristic.

DTR = 1 sets the dimming curve to linear. In this case the light output shall be a linear function of the light level given by any of the arc power control commands according to the formula

$$X(n) = \frac{n}{254} \cdot 100 \ [\%]$$

where

X = light output, expressed in %;

n = light level given by any of the arc power control commands.

All other values of the DTR are reserved for future needs and shall be not change the dimming curve.

This setting shall be retained in non-volatile memory, and not cleared by a RESET command.

Commands 226-227:   YAAA AAA1 1110 001X

Reserved for future needs. The control gear must not react in any way.

Commands 228-231:   YAAA AAA1 1110 01XX

Reserved for future needs. The control gear must not react in any way.

Commands 232-235: YAAA AAA1 1110 10XX

Reserved for future needs. The control gear must not react in any way.

Commands 236-237: YAAA AAA1 1110 110X

Reserved for future needs. The control gear must not react in any way.

11.3.4.2 Application extended query commands

Command 238:   YAAA AAA1 1110 1110   "QUERY DIMMING CURVE"

The answer shall be the dimming curve currently in use:

0 = standard logarithmic

1 = linear

NOTE 1   2-255 are reserved for future use, as specified in Table 1.

Command 239:   YAAA AAA1 1110 1111   "QUERY DIMMER STATUS"

The answer shall be the following information:

bit 0 leading edge mode running

bit 1 trailing edge mode running   } Dimming method bits, see command 240

bit 2 reference measurement running   '0' = No

bit 3 reserved for future use   '0' = default value

bit 4 non-logarithmic dimming curve active   '0' = No

bit 5 reserved for future use   '0' = default value

bit 6 reserved for future use   '0' = default value

bit 7 reserved for future use   '0' = default value

The 'QUERY DIMMER STATUS' byte shall be updated regularly by the control gear according to the actual situation.

Command 240:   YAAA AAA1 1111 0000   "QUERY FEATURES"

Answer shall be byte 1 of the feature information. Byte 2 of the feature information shall be automatically transferred to DTR and byte 3 of the feature information shall be automatically transferred into DTR1 after reception of this command.

Feature byte 1 (back-channel):

bit 0 '1' = load over-current shutdown can be queried   '0' = No

bit 1 '1' = open circuit (no load) detection can be queried   '0' = No

bit 2 '1' = detection of load decrease can be queried   '0' = No

bit 3 '1' = detection of load increase can be queried   '0' = No

bit 4 reserved   '0' = default value

bit 5 '1' = thermal shutdown can be queried   '0' = No

bit 6 '1' = thermal overload with output level reduction can be
       queried   '0' = No

bit 7 '1' = physical selection supported   '0' = No

Feature byte 2 (DTR):

bit 0 Temperature can be queried   '0' = No

bit 1 Supply voltage can be queried   '0' = No

bit 2 Supply frequency can be queried   '0' = No

bit 3 Load voltage can be queried   '0' = No

bit 4 Load current can be queried	'0' = No
bit 5 Real load power can be queried	'0' = No
bit 6 Load rating can be queried	'0' = No
bit 7 Load current overload with output level reduction can be queried	'0' = No

Feature byte 3 (DTR1):

bit 0 Dimming method bit 0	see table below
bit 1 Dimming method bit 1	see table below
bit 2 reserved	'0' = default value
bit 3 non-logarithmic dimming curve can be selected	'0' = No
bit 4 reserved	'0' = default value
bit 5 reserved	'0' = default value
bit 6 reserved	'0' = default value
bit 7 Load unsuitable can be queried	'0' = No

Dimming method bits (bit 0 and bit 1 of feature byte 3) are shown in Table 2.

Table 2 – Dimming method bits

bit 1	bit 0	Dimming method
0	0	leading & trailing
0	1	leading only
1	0	trailing only
1	1	sine wave

Back-channel bits 2 and 3 of feature byte 1: If one or more of these features is available, command 224 'REFERENCE SYSTEM POWER' command 249 'QUERY REFERENCE RUNNING' and command 250 'QUERY REFERENCE MEASUREMENT FAILED' are essential.

NOTE 2   The fact that a thermal overload protection whose actual status can be queried is implemented does not relieve the user from the obligation to comply with the relevant safety instructions for installation given by the manufacturer.

Command 241:   **YAAA AAA1 1111 0001**   **"QUERY FAILURE STATUS"**

Answer shall be byte 1 of the failure status information. Byte 2 of the failure status information shall be automatically transferred into DTR1 after reception of this command.

Failure Status byte 1 (back-channel):

bit 0 load over-current shutdown	'0' = No
bit 1 open circuit (no load) detec	'0' = No
bit 2 load decrease detected	'0' = No
bit 3 load increase detected	'0' = No
bit 4 reserved	'0' = default value
bit 5 thermal shutdown	'0' = No
bit 6 thermal overload with output level reduction	'0' = No
bit 7 reference measurement failed	'0' = No

Failure Status byte 2 (DTR1):

bit 0	load not suitable for selected dimming method, caused shutdown	'0' = No
bit 1	supply voltage out of limits	'0' = No
bit 2	supply frequency out of limits	'0' = No
bit 3	load voltage out of limits	'0' = No
bit 4	load current overload with output level reduction	'0' = No
bit 5	reserved	'0' = default value
bit 6	reserved	'0' = default value
bit 7	reserved	'0' = default value

Back-channel bit 7 shall be set if the reference measurement of the system power failed for any reason, or if there has been no reference measurement at all. It shall be stored in the persistent memory.

If reference measurement is not supported, this bit shall always be '0'.

DTR1 bits 1, 2 and 3 indicate a problem with the supply or load. These conditions might cause output level reduction or shutdown.

Failure states which cause output level reduction shall only be reset by re-powering the control gear or by any command that causes the output to turn off. The output level cannot be increased above the reduced level, until the failure condition is cleared.

Failure states which cause shutdown shall only be reset by re-powering the control gear or using an optional reset switch on the control gear.

NOTE 3   Shutdown should not be reset from the interface.

NOTE 4   Detection of a load current overload (back-channel bit 0) is control gear, manufacturer, and possibly dimming method specific. This occurs when the control gear fails to keep the load current in range, despite reducing the output level.

The 'FAILURE STATUS' shall be updated regularly by the control gear according to the actual situation.

If any of back-channel bits 0 to 3, or DTR1 bits 0, 3 and 4 are set, the answer to command 146 'QUERY LAMP FAILURE' shall be 'Yes' and bit 1 in the answer of command 144 'QUERY STATUS' shall be set.

If any of back-channel bits 5 and 6, or DTR1 bits 1 and 2 are set, bit 0 in the answer to command 144 'QUERY STATUS' shall be set.

If any of the back-channel bits 0, 1, 5 or 6 or the DTR1 bits 0 or 4 are set, the answer to command 160 "QUERY ACTUAL LEVEL" shall be 'MASK'.

Command 242:   **YAAAAAA1 1111 0010**   **"QUERY DIMMER TEMPERATURE"**

The answer shall be an indication of the temperature of the dimmer with 1 °C resolution. Values of 0 to 254 represent temperatures of –40 °C to +214 °C. Below –40 °C, 0 is returned. Above +214 °C, 254 is returned. A value of 255 means "unknown".

Control gear without this feature shall not react.

Command 243:   **YAAA AAA1 1111 0011**   **"QUERY RMS SUPPLY VOLTAGE"**

The answer shall be the measured supply voltage. Values of 0 to 254 represent 0 V to 508 V RMS. Voltages above 508 V shall be returned as 254. A value of 255 means "unknown".