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colour inside

Lighting control interface for dimming – Analogue voltage dimming interface for electronic current sourcing controlgear

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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LIGHTING CONTROL INTERFACE FOR DIMMING – ANALOGUE VOLTAGE DIMMING INTERFACE FOR ELECTRONIC CURRENT SOURCING CONTROLGEAR

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1 Scope

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This document does not specify safety requirements for the analogue interface of controlgear. Safety requirements are given in IEC 61347 (all parts).

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controlgear
<for an electric light source> unit inserted between the electrical supply and at least one light source, which serves to supply the light source(s) with its (their) rated voltage or rated current, and can consist of one or more separate components

Note 1 to entry: The controlgear may include means for igniting, dimming, correcting the power factor and suppressing radio interference, and further control functions.

Note 2 to entry: The controlgear consists of a power supply and a control unit.

Note 3 to entry: The terms “control gear” and “controlgear” are interchangeable. In IEC standards, the term “controlgear” is commonly used.

3.2
controllable lamp controlgear
electronic controlgear whose lamp operating characteristics can be changed by means of a separate control input signal

[SOURCE: IEC 61347-1:2015, 3.2.3, modified – "ballast" has been replaced with "lamp controlgear" and "a signal via mains or extra control input" has been replaced with "a separate control input signal".]

3.3
control terminal
terminal intended to connect an item to a circuit or device capable of supplying or receiving an electronic control signal to the item

Note 1 to entry: Control inputs for other control signals (for example IEC 62386 (all parts), IEC 62756-1) are excluded.

[SOURCE: IEC 60050-845:—, 845-28-062, modified – The note has been added.]

3.4
control signal
DC voltage that is used to set the output power of the lamp controlgear

3.5
control unit of the controlgear
<for an LED light source> electronic device, being part of the controlgear, designed for controlling the electric energy to the LED light source

Note 1 to entry: The purpose of controlling the electric energy can be colour mixing, responding to depreciating luminous flux, and other features.

Note 2 to entry: In LEDsi modules, the control unit of the control gear is part of the LED module and separate from the power supply of the control gear.

[SOURCE: IEC 60050-845:—, 845-28-057]

3.8
correlated colour temperature factor
CCTF
ratio of the dimmed CCT to the full power CCT

Note 1 to entry: This ratio is used in the calculation of warm dimming responses for applicable LED systems.

Note 2 to entry: CCT (correlated colour temperature) is defined in IEV 845-23-068.

3.6
electric light source
light source
primary light source with the means for connecting to the electric supply and usually designed to be incorporated into a luminaire

Note 1 to entry: An electric light source can be a lamp, provided with a lamp cap, or LED module designed to be connected by terminals, connectors or similar devices.

3.7
output power
<of an electronic lamp controlgear> electrical power supplied from the electronic lamp controlgear at the output terminals of the electronic lamp controlgear

3.9
warm dimming
capability of controlgear to decrease the colour temperature of its LED light sources as the power, and therefore the luminous flux output of the light sources is decreased

4 General remarks on tests

4.1 Disconnected control signal

If the control signal is not received, the lamp controlgear shall provide the rated power or maximum of the rated power range or the system failure level, if applicable and described by the manufacturer.

4.2 Type test

Tests according to this document are type tests.

The requirements and tolerances permitted by this document are based on the testing of a type test sample submitted by the manufacturer for that purpose. In principle this type test sample should consist of units having characteristics typical of the manufacturer's production and be as close to the production centre point values as possible. For guidance on sampling plans and procedures for inspection by attributes, see ISO 2859-1.

4.3 Test order and application of test

The tests shall be carried out in the order of the clauses, unless otherwise specified.

One lamp controlgear shall be submitted to all tests, unless otherwise stated.

In general, all tests are made on each type of lamp controlgear or where a power range of similar lamp controlgear is involved, for each rated power in the range or on a representative selection from the range as given by the manufacturer.

5 Marking

Controllable electronic light source controlgear in accordance with this document shall be clearly marked with the following marking (see Figure 1):

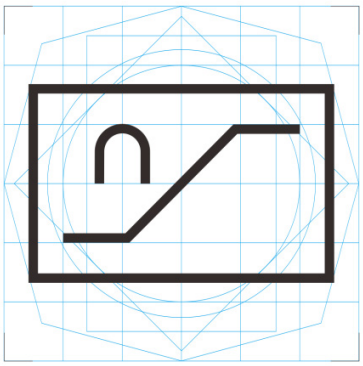


Figure 1 – Marking of controllable electronic light source controlgear

~~The preferred marking size should be 8 mm x 16 mm (H x L).~~

Markings should be readable with normal vision.

6 System description

6.1 General

The circuit diagram of the functional specification for DC voltage control is shown in Figure 2.

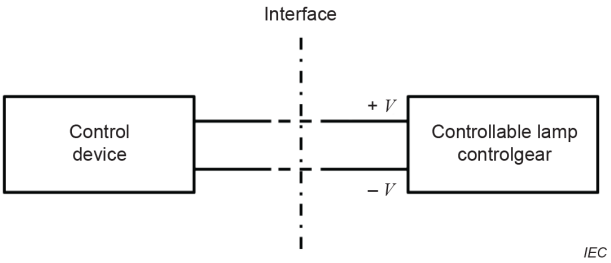


Figure 2 – Functional specification for DC voltage control

The output power of a controllable lamp controlgear is controlled by the control signal applied to the control input of the controllable lamp controlgear.

Depending on the current sink capability of the control device, and the total maximum source current for all controllable lamp controlgear, several controllable lamp controlgear can be connected to one control device (see Figure 3).

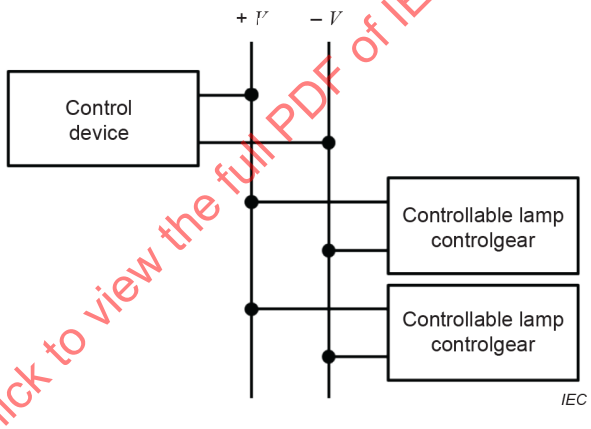


Figure 3 – Connection diagram for several controllable electronic lamp controlgear

6.2 Control signal voltage range and characteristics

The control input voltage V shall be in the range of:

$$-20\ \text{V} < V < +20\ \text{V}.$$

In this range the controlgear shall not be damaged.

The control terminals shall be protected against the application of reversed polarity. In that case, the electronic lamp controlgear shall operate with minimum output power or shall not operate.

The control signal shall have the following characteristics:

Control signal range

V = between 0 V and 1 V: minimum value of output power (minimum light output).

V = between 1 V and 10 V: output power increasing from minimum to maximum value, see 6.3.

V = between 10 V and 11 V: maximum value of output power (maximum light output)

V = between 0 V and 11 V: stable output power, where stable light output is expected.

If the control terminals of the controllable controlgear are not connected to a control device (open circuit) the controlgear shall provide the maximum output power (the light output shall be the maximum light output).

This shall be tested by measuring the output power.

6.3 Dimming curve

The dimming curve is defined using the values in Table 1.

Table 1 – Control signal related to the electronic light source controlgear output power (light level of the dimming curve)

Control signal voltage VDC at the electronic light source controlgear control terminals in V	Minimum output power in % of the maximum level	Maximum output power in % of the maximum level
≤ 1	min	min +15
5	45	65
7	70	90
10	90	100
> 10	100	100
NOTE If the electronic lamp controlgear is designed as a power source based on a current source, then the values given in the table are percentages of the rated current. If the electronic lamp controlgear is designed as a power source based on a voltage source, then the values given in the table are the percentages of the rated voltage.		

In the case of electronic light source controlgear with a minimum physically possible value of output power higher than a value in the table, the table shall be applied only above this lowest possible value.

6.4 Control input current limits

Controlgear in relation to this document acts as a current source. Limits for the control input current to be sourced by the controlgear are 100 µA minimum and 2 mA maximum, for the input voltage range of 0 V to 11 V.

The nominal value of the control input current shall be declared in the manufacturer's literature or stated on the lamp controlgear.

6.5 Switch-on

The switch-on of the controlgear is permitted at any dimming position.

This shall be tested by visual inspection.

7 Simulation of incandescent dimming (optional)

7.1 General

Warm dimming is an optional feature implemented in some lighting controlgear to imitate the behaviour of incandescent filament sources as the power supplied to them is decreased. If warm dimming is implemented, 7.2 shall apply.

For lighting systems that implement warm dimming and can utilize a variety of luminaires or light sources, uniform warm dimming response can be important for colour consistency throughout the lighting system.

7.2 Response to light source dimming

For an LED dim-to-warm system, the resultant output CCT for a given output power P, is determined as follows:

$$P_r = P/P_{max}$$

$$CCTF = P_r^{0,37}$$

$$CCT = CCTF \times CCT_{max}$$

where

P is the power delivered to the LEDs;

P_{max} is the maximum undimmed power delivered to the LEDs;

P_r is the relative power;

$CCTF$ is the CCT factor;

CCT_{max} is the maximum CCT;

CCT is the resultant output CCT at the given output power P.

Annex A provides examples of a relationship between the CCTF and an analogue 0 V to 10 V control voltage.

When implementing warm dimming, it is recommended that the minimum CCT is no less than 1 800 K.

7.3 Dim-to-warm marking

Electronic light source controlgear utilizing the dim-to-warm functionality in accordance with this document shall be clearly marked with the following marking (see Figure 4):

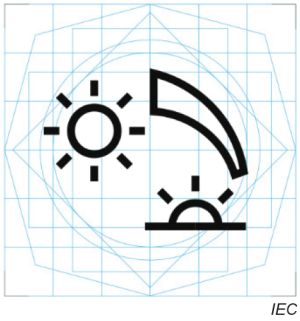


Figure 4 – Marking of dim-to-warm electronic light source controlgear

Markings should be readable with normal vision.

Annex A
(informative)

Warm dim control for analogue dimming having controlgear with a linear output power to control voltage response

A.1 General

Typically, dimming an LED simply lowers its luminous flux output while maintaining its rated colour temperature. Legacy heated filament lamps (incandescent) respond to dimming by a significant shift to warmer colour temperatures at lower power. This dim-to-warm characteristic is often a desirable response. Implementation of a dim-to-warm feature in an LED luminaire allows this response to be available along with the other positive features of LED equipment.

Typical warm dim systems utilize a dimmable LED driver with at least two output channels. Each channel controls an LED of a different colour temperature (CCT). The overall CCT of the system is controlled by independently varying the power delivered to each of the LEDs and mixing the output of all the LED sources to achieve a composite, uniform CCT. As an example, a basic block diagram of a two-channel system is shown in Figure A.1.

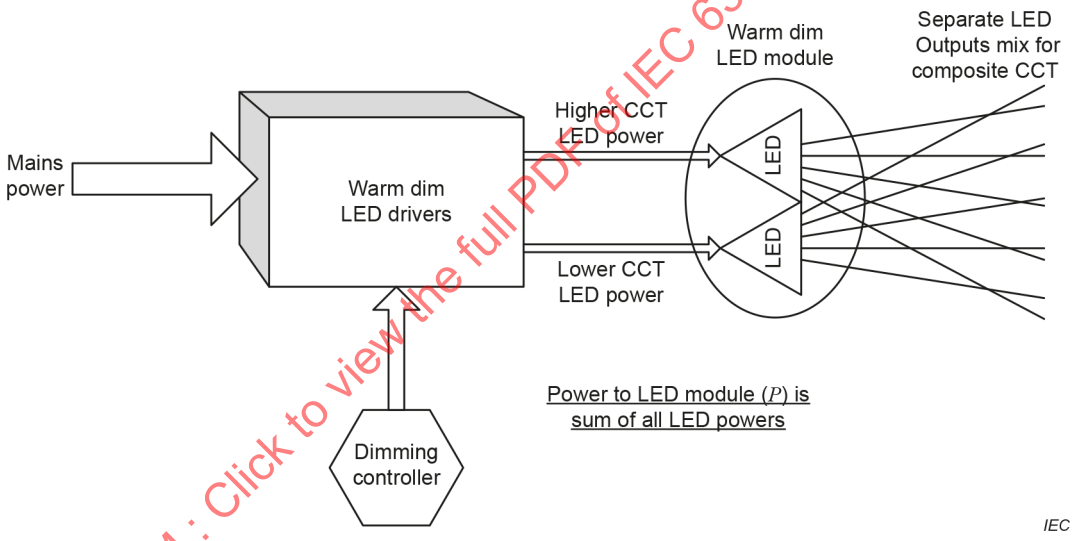


Figure A.1 – Typical warm dimming LED system utilizing two LED sources

A.2 Correlation to 0 V to 10 V control

In the warm dim control standard as described in Clause 7, the CCT during dimming is based on the relative power supplied to the LED source. Determining the CCT factor as a function of the 0 V to 10 V control voltage, V_c, of an analogue dimmer is more complex since the control voltage to power function is not completely defined for the controlgear. The minimum dimmed power depends on the design of the controlgear and should be taken into account in the calculation of the CCTF.

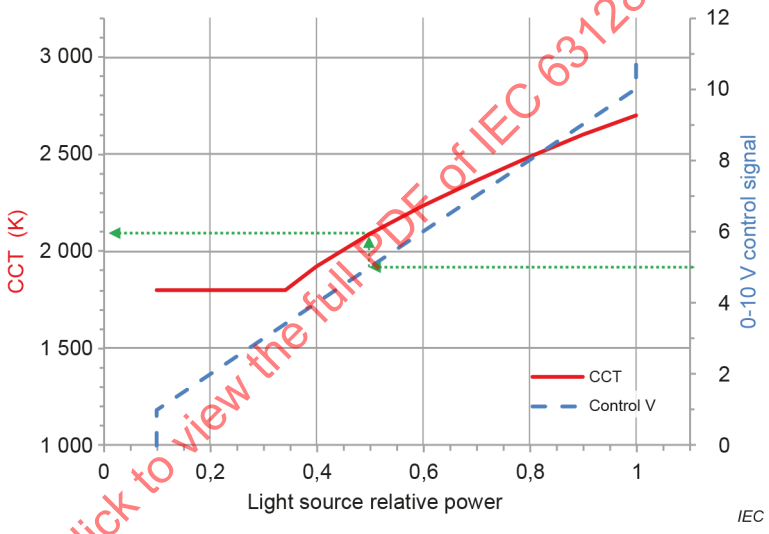
For controlgear that meets the following criteria, the CCTF for a given control voltage V_c can be calculated using Formula (A.1) where:

- the total LED power, P, is the sum of all power delivered to the LEDs involved in the dim-to-warm function;
- the minimum total LED power, P_{min}, occurs when $V_c = V_{min}$;

- the maximum total LED power, P_{max}, occurs when $V_c = V_{max}$;
- the minimum relative power, $P_{r(min),} = P_{min} / P_{max}$;
- the controlgear output increases linearly between minimum and maximum power.

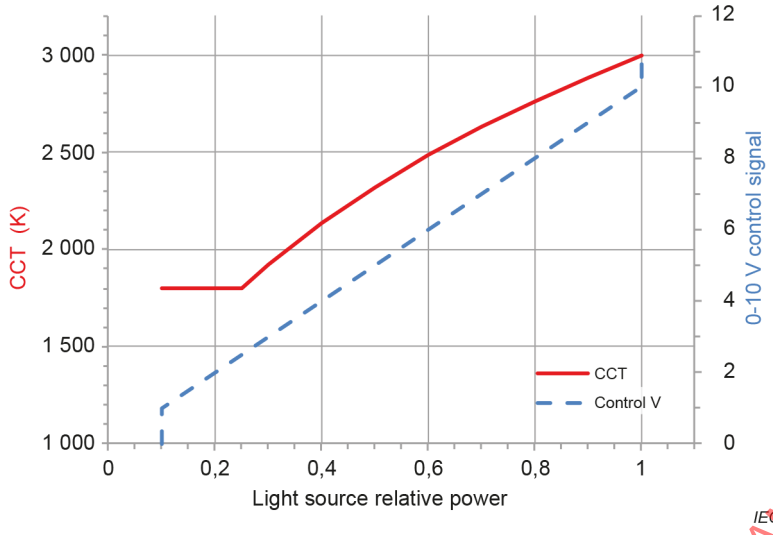
$$CCTF\left(V_c\right) = \left(\left(\frac{V_c - V_{min}}{V_{max} - V_{min}}\right) \times \left(1 - P_{r(min)}\right) + P_{r(min)}\right)^{0,37} \quad (A.1)$$

A graphical representation of the relationship between CCTF, relative LED power and a 0 V to 10 V control signal for a warm dim system is shown in Figure A.2, Figure A.3 and Figure A.4 for three different configurations. The required CCT and the 0 V to 10 V control are shown on the two vertical axes as a function of relative power. To find a CCT for a desired control voltage, the voltage is located on the right vertical axis, projected across to the dashed plot then projected vertically to the CCT curve where the required CCT is found on the left vertical axis. The process is shown with dotted lines in Figure A.2 for a 5 V control voltage resulting in an approximate CCT of 2 100 K (actually 2 089 K). All examples assume the CCT will not drop below 1 800 K.



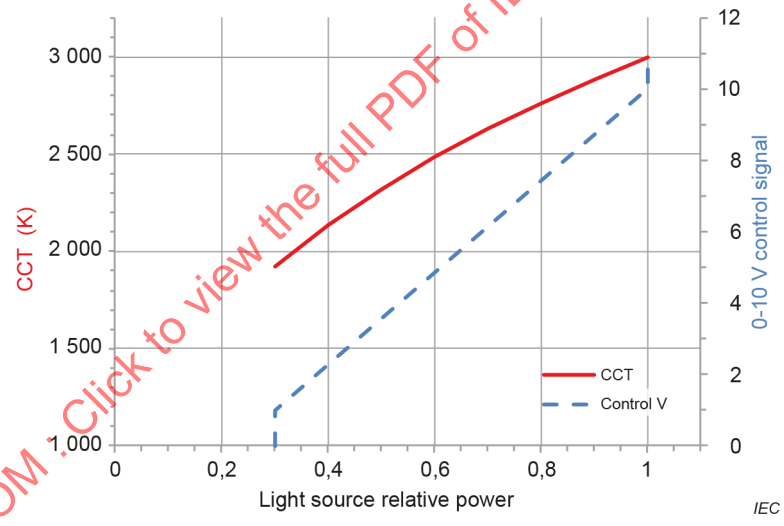
NOTE The CCT flattens out at the minimum of 1 800 K at approximately 35 % of full power.

Figure A.2 – Full power rated CCT: 2 700 K – Dimmed relative power minimum: 10 %



NOTE The CCT flattens out at the minimum of 1 800 K at approximately 25 % of full power. The minimum is reached later in the dim curve than for that shown in Figure A.2 because the CCT at full power is higher.

Figure A.3 – Full power rated CCT: 3 000 K – Dimmed relative power minimum: 10 %



NOTE The CCT does not flatten out as shown in Figure A.2 and Figure A.3 because the minimum relative power is higher, so the 1 800 K limit is not reached.

Figure A.4 – Full power rated CCT: 3 000 K – Dimmed relative power minimum: 30 %

Bibliography

[1] IEC 60050-845:—[1], *International Electrotechnical Vocabulary – Part 845: Lighting*

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

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

[4] IEC 61347-2-2, *Lamp controlgear – Part 2-2: Particular requirements for d.c. or a.c. supplied electronic step-down convertors for filament lamps*

[5] IEC 61347-2-3, *Lamp controlgear – Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic controlgear for fluorescent lamps*

[6] IEC 61347-2-12, *Lamp controlgear – Part 2-12: Particular requirements for d.c. or a.c. supplied electronic ballasts for discharge lamps (excluding fluorescent lamps)*

[7] IEC 61347-2-13, *Lamp controlgear – Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules*

[8] IEC 60081, *Double-capped fluorescent lamps – Performance specifications*

[9] IEC 60901, *Single-capped fluorescent lamps – Performance specifications*

[10] IEC 60929, *AC and/or DC-supplied electronic controlgear for tubular fluorescent lamps – Performance requirements*

[11] IEC 61047, *DC or AC supplied electronic step-down convertors for filament lamps – Performance requirements*

[12] IEC 61167, *Metal Halide lamps – Performance specification*

[13] IEC 62384, *DC or AC supplied electronic controlgear for LED modules – Performance requirements*

[14] IEC 62386 (all parts), *Digital addressable lighting interface*

[15] IEC 62717, *LED modules for general lighting – Performance requirements*

[16] IEC 62756-1, *Digital load side transmission lighting control (DLT) – Part 1: Basic requirements*

[17] IEC 62811, *AC and/or DC-supplied electronic controlgear for discharge lamps (excluding fluorescent lamps) – Performance requirements for low frequency square wave operation*

[18] ISO 2859-1, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

[1] Under preparation. Stage at the time of publication IEC PRVC IEC 60050-845:2019.

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Note 2 to entry: The controlgear consists of a power supply and a control unit.

Note 3 to entry: The terms “control gear” and “controlgear” are interchangeable. In IEC standards, the term “controlgear” is commonly used.

3.2
controllable lamp controlgear
electronic controlgear whose lamp operating characteristics can be changed by means of a separate control input signal

[SOURCE: IEC 61347-1:2015, 3.2.3, modified – "ballast" has been replaced with "lamp controlgear" and "a signal via mains or extra control input" has been replaced with "a separate control input signal".]

3.3
control terminal
terminal intended to connect an item to a circuit or device capable of supplying or receiving an electronic control signal to the item

Note 1 to entry: Control inputs for other control signals (for example IEC 62386 (all parts), IEC 62756-1) are excluded.

[SOURCE: IEC 60050-845:—, 845-28-062, modified – The note has been added.]

3.4
control signal
DC voltage that is used to set the output power of the lamp controlgear

3.5
control unit of the controlgear
<for an LED light source> electronic device, being part of the controlgear, designed for controlling the electric energy to the LED light source

Note 1 to entry: The purpose of controlling the electric energy can be colour mixing, responding to depreciating luminous flux, and other features.

Note 2 to entry: In LEDsi modules, the control unit of the control gear is part of the LED module and separate from the power supply of the control gear.

[SOURCE: IEC 60050-845:—, 845-28-057]

3.8
correlated colour temperature factor
CCTF
ratio of the dimmed CCT to the full power CCT

Note 1 to entry: This ratio is used in the calculation of warm dimming responses for applicable LED systems.

Note 2 to entry: CCT (correlated colour temperature) is defined in IEV 845-23-068.

3.6
electric light source
light source
primary light source with the means for connecting to the electric supply and usually designed to be incorporated into a luminaire

Note 1 to entry: An electric light source can be a lamp, provided with a lamp cap, or LED module designed to be connected by terminals, connectors or similar devices.

3.7
output power
<of an electronic lamp controlgear> electrical power supplied from the electronic lamp controlgear at the output terminals of the electronic lamp controlgear

3.9
warm dimming
capability of controlgear to decrease the colour temperature of its LED light sources as the power, and therefore the luminous flux output of the light sources is decreased

4 General remarks on tests

4.1 Disconnected control signal

If the control signal is not received, the lamp controlgear shall provide the rated power or maximum of the rated power range or the system failure level, if applicable and described by the manufacturer.

4.2 Type test

Tests according to this document are type tests.

The requirements and tolerances permitted by this document are based on the testing of a type test sample submitted by the manufacturer for that purpose. In principle this type test sample should consist of units having characteristics typical of the manufacturer's production and be as close to the production centre point values as possible. For guidance on sampling plans and procedures for inspection by attributes, see ISO 2859-1.

4.3 Test order and application of test

The tests shall be carried out in the order of the clauses, unless otherwise specified.

One lamp controlgear shall be submitted to all tests, unless otherwise stated.

In general, all tests are made on each type of lamp controlgear or where a power range of similar lamp controlgear is involved, for each rated power in the range or on a representative selection from the range as given by the manufacturer.

5 Marking

Controllable electronic light source controlgear in accordance with this document shall be clearly marked with the following marking (see Figure 1):

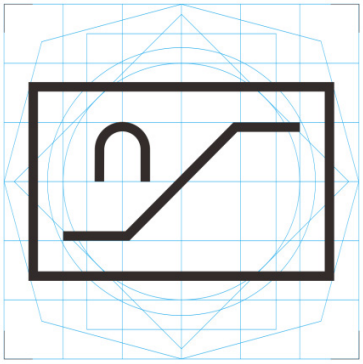

Figure 1 – Marking of controllable electronic light source controlgear

Markings should be readable with normal vision.

6 System description

6.1 General

The circuit diagram of the functional specification for DC voltage control is shown in Figure 2.

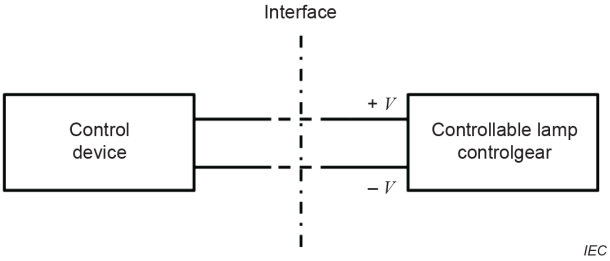

Figure 2 – Functional specification for DC voltage control

The output power of a controllable lamp controlgear is controlled by the control signal applied to the control input of the controllable lamp controlgear.

Depending on the current sink capability of the control device, and the total maximum source current for all controllable lamp controlgear, several controllable lamp controlgear can be connected to one control device (see Figure 3).

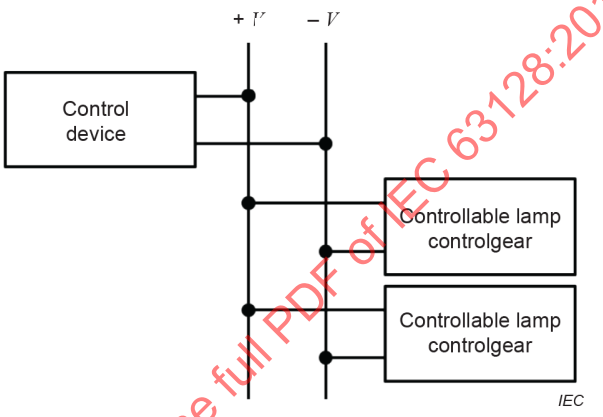

Figure 3 – Connection diagram for several controllable electronic lamp controlgear

6.2 Control signal voltage range and characteristics

The control input voltage V shall be in the range of:

$$-20\ \text{V} < V < +20\ \text{V}.$$

In this range the controlgear shall not be damaged.

The control terminals shall be protected against the application of reversed polarity. In that case, the electronic lamp controlgear shall operate with minimum output power or shall not operate.

The control signal shall have the following characteristics:

Control signal range

V = between 0 V and 1 V: minimum value of output power (minimum light output).

V = between 1 V and 10 V: output power increasing from minimum to maximum value, see 6.3.

V = between 10 V and 11 V: maximum value of output power (maximum light output)

V = between 0 V and 11 V: stable output power, where stable light output is expected.

If the control terminals of the controllable controlgear are not connected to a control device (open circuit) the controlgear shall provide the maximum output power (the light output shall be the maximum light output).

This shall be tested by measuring the output power.

6.3 Dimming curve

The dimming curve is defined using the values in Table 1.

Table 1 – Control signal related to the electronic light source controlgear output power (light level of the dimming curve)

Control signal voltage VDC at the electronic light source controlgear control terminals in V	Minimum output power in % of the maximum level	Maximum output power in % of the maximum level
≤ 1	min	min +15
5	45	65
7	70	90
10	90	100
> 10	100	100
NOTE If the electronic lamp controlgear is designed as a power source based on a current source, then the values given in the table are percentages of the rated current. If the electronic lamp controlgear is designed as a power source based on a voltage source, then the values given in the table are the percentages of the rated voltage.		

In the case of electronic light source controlgear with a minimum physically possible value of output power higher than a value in the table, the table shall be applied only above this lowest possible value.

6.4 Control input current limits

Controlgear in relation to this document acts as a current source. Limits for the control input current to be sourced by the controlgear are 100 µA minimum and 2 mA maximum, for the input voltage range of 0 V to 11 V.

The nominal value of the control input current shall be declared in the manufacturer's literature or stated on the lamp controlgear.

6.5 Switch-on

The switch-on of the controlgear is permitted at any dimming position.

This shall be tested by visual inspection.

7 Simulation of incandescent dimming (optional)

7.1 General

Warm dimming is an optional feature implemented in some lighting controlgear to imitate the behaviour of incandescent filament sources as the power supplied to them is decreased. If warm dimming is implemented, 7.2 shall apply.