BSR/ASHRAE Addendum *ca* to
ANSI/ASHRAE Standard 135-2016

Public Review Draft

Proposed Addendum *ca* to Standard 135-2016, BACnet® - A Data Communication Protocol for Building Automation and Control Networks

First Public Review (April 2020)
(Draft shows Proposed Changes to Current Standard)

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[This foreword and the "rationales" on the following pages are not part of this standard. They are merely informative and do not contain requirements necessary for conformance to the standard.]

FOREWORD

The purpose of this addendum is to present a proposed change for public review. These modifications are the result of change proposals made pursuant to the ASHRAE continuous maintenance procedures and of deliberations within Standing Standard Project Committee 135. The proposed changes are summarized below.

In the following document, language to be added to existing clauses of ANSI/ASHRAE 135-2016 and Addenda is indicated through the use of *italics*, while deletions are indicated by ~~strikethrough~~. Where entirely new subclauses are proposed to be added, plain type is used throughout. Only this new and deleted text is open to comment at this time. All other material in this document is provided for context only and is not open for public review comment except as it relates to the proposed changes.

The use of placeholders like X, Y, Z, X1, X2, N, NN, x, n, ?, etc., should not be interpreted as literal values of the final published version. These placeholders will be assigned actual numbers/letters only after final publication approval of the addendum.

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135-2016*ca*-1. Introduce the Concept of Color for BACnet

[The following introduction is informative and provided as background information and rationale for this addendum. It will not be part of the standard.]

INTRODUCTION

The BACnet Lighting Output (LO) and Binary Lighting Output (BLO) objects provide support for lighting applications and a standardized object model for white light endpoints that perform lighting control. In representing lighting applications with these object types, the central idea is the control of luminance on a normalized scale from off to some maximum lighting level. These objects do not address the concept of color in their object models. There are architectural and even commercial lighting applications, where color is a useful and important concept. There are other applications where it would be advantageous to model color, and changing color, as a characteristic not even necessarily coupled to lighting.

It is increasingly common to incorporate color control into lighting applications. However, most lighting applications separate the concept of luminance from the concept of color itself. There are several different color models in widespread use. These proposals focus on the use of the **CIE 15: 2004 Chromaticity Diagram** that models color as an x-y space and specific colors are (x,y) coordinates within this space. Color endpoints such as lighting controller outputs or luminaires are thus represented in BACnet as a pair of objects such as an LO and a Color object. The LO controls the luminance while the Color controls the x-y color.

The proposed Color object incorporates ideas from the lighting output objects in terms of fading, ramping, and stepping. There is a significant difference between the concept in the lighting objects where Present_Value is *commandable*, and the Color object where Present_Value is not commandable. This difference is intentional and represents the different way that color lighting is commonly controlled vs. simple luminance in white light applications. In white light applications, it is common to have more than one source of control, for example, scheduled lighting level changes and changes initiated by a local controller device (dimmer or switch). The prioritization scheme that BACnet uses is directly applicable to this kind of application. However, in color lighting applications, there is typically only one source for the desired color. Because of this, there is no use case where arbitration is required between multiple color control clients and a color endpoint.

There is a notable exception. In some color applications such as vivaria, it is desirable to control color over a long period of time, for example, fading between specific colors over many hours. The scenario when a second “color” might be needed would be, for example, an emergency or maintenance situation when the normal long-term color fade must be temporarily interrupted, perhaps with pure white light until the emergency is dealt with. At the end of the emergency, the normal color control can take over and restore the color to where it would have been if it was not interrupted. The point is that there are only ever two sources for color information: normal operation and emergency operation. As a result, color does not require the complexity of commandability when a much simpler mechanism can provide a solution to the only use cases we have identified.

There is also the concept of color temperature. In some cases, the “color” that is to be controlled is actually the white light color temperature, which is a specific region of the x-y color space called the white light curve. Color temperature applications are distinctly different from full color applications, sufficiently so that a separate Color Temperature object is also proposed.

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135-2016*ca*-2. Add new Color object type

Rationale

The 135-2016 Lighting Output and Binary Lighting Output objects do not address the concept of color in their object models. There are architectural and even commercial lighting applications, where color is a useful and important concept. There are other applications where it would be advantageous to model color, and changing color, as a characteristic not even necessarily coupled to lighting.

These changes extend the BACnet object model to accommodate color.

[Change 3.2]

fading: the gradual increase or decrease of the ~~actual output~~ *luminance* from one setting to another over a fixed period of time*, or the change of color or color temperature from one color to another over a fixed period of time, or a change of both luminance level and color.*

xyColor: *The numeric representation of a color in terms of its (x,y) coordinates in the CIE chromaticity diagram, independent of its luminance.*

[Change Table 12-63]

Table 12-63 – Datatype Coercion Rules

					Datatype of referenced property											
Datatype in Present_Value write	unknown	BOOLEAN	Unsigned	INTEGER	REAL	Double	OCTET STRING	CharacterString	BIT STRING	ENUMERATED	Date	Time	BACnetObjectIdentifier	BACnetLightingCommand	*BACnetColorCommand*	*BACnetxyColor*
NULL	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	ID	*ID*	*ID*
BOOLEAN	NC	NC	2	2	2	2	ID	ID	ID	2	ID	ID	ID	ID	*ID*	*ID*
Unsigned	NC	1	NC	3	3	3	ID	ID	ID	NC	ID	ID	NC	ID	*ID*	*ID*
INTEGER	NC	1	4	NC	4	4	ID	ID	ID	4	ID	ID	ID	ID	*ID*	*ID*
REAL	NC	1	5	5	NC	5	ID	ID	ID	5	ID	ID	ID	ID	*ID*	*ID*
Double	NC	1	6	6	6	NC	ID	ID	ID	6	ID	ID	ID	ID	*ID*	*ID*
OCTET STRING	NC	ID	ID	ID	ID	ID	NC	ID	ID	ID	ID	ID	ID	ID	*ID*	*ID*
CharacterString	NC	ID	ID	ID	ID	ID	ID	NC	ID	ID	ID	ID	ID	ID	*ID*	*ID*
BIT STRING	NC	ID	ID	ID	ID	ID	ID	ID	NC	ID	ID	ID	ID	ID	*ID*	*ID*
ENUMERATED	NC	1	NC	3	3	3	ID	ID	ID	NC	ID	ID	ID	ID	*ID*	*ID*
Date	NC	ID	ID	ID	ID	ID	ID	ID	ID	ID	NC	ID	ID	ID	*ID*	*ID*
Time	NC	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	NC	ID	ID	*ID*	*ID*
BACnetObjectIdentifier	NC	ID	NC	ID	ID	ID	ID	ID	ID	ID	ID	ID	NC	ID	*ID*	*ID*
BACnetLightingCommand	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	NC	*ID*	*ID*
BACnetColorCommand	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	NC	*ID*
BACnetxyColor	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*ID*	*NC*

NC=No Coercion ID=Invalid Datatype

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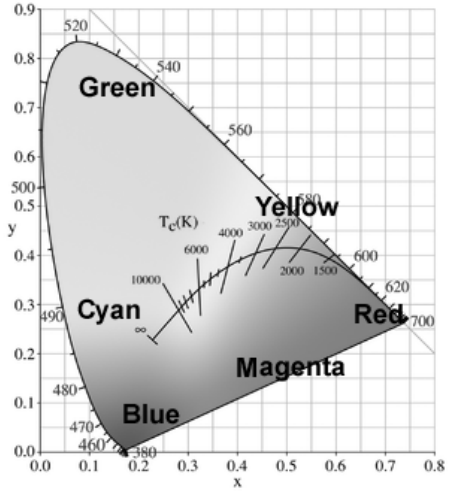
[Add **12.X**, Color Object Type]

12.X Color Object Type

The Color object type defines a standardized object whose properties represent the externally visible characteristics of a color. This color may be used to affect the visible color produced by any device, typically, but not limited to, lighting outputs. The Color object includes dedicated functionality specific to color control that would otherwise require explicit programming. The color itself is analog in nature and shall be referred to as "color output." The color may be used by the device in various applications, for example, to represent the color of light produced by a lighting device. There is an implicit connection in such cases between the object that controls luminance, e.g., a Lighting Output or Binary Lighting Output, and a Color object that controls its color. This connection is BACnet-visible in the Color_Reference and Override_Color_Reference properties of those objects. See 12.54.X, 12.54.Z, 12.55.X, and 12.55.Z.

The color can be changed directly to an absolute color by writing to the Present_Value of the Color object. The color may also be changed by writing to the Color_Command property. The color command provides additional color control functionality with specific functions such as fading.



The Color object supports a single color-model called xyColor. In the xyColor model, the parameters are the x and y coordinates of the color on the CIE chromaticity diagram (**CIE 15: 2004)**, expressed as a pair of numbers each in the range 0 to 1. Writes of BACnetxyColor values that are outside the range 0 to 1 shall be considered "values out of range." Values within the range 0 to 1 but not within the curved space of the CIE chromaticity diagram, or xy values not supported by the device, may be considered "values out-of-range" or choose the closest color supported, the choice being a local matter. The algorithm used to determine the closest color shall be a local matter. When fading from one color to another, the algorithm used to determine the intermediate colors shall be a local matter.

Figure 12-X: CIE Chromaticity Diagram

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The object and its properties are summarized in Table 12-X and described in detail in this subclause.

Table 12-X. Properties of the Color Object

Property Identifier	Property Datatype	Conformance Code
Object_Identifier	BACnetObjectIdentifier	R
Object_Name	CharacterString	R
Object_Type	BACnetObjectType	R
Present_Value	BACnetxyColor	W
Tracking_Value	BACnetxyColor	R
Color_Command	BACnetColorCommand	W
In_Progress	BACnetColorOperationInProgress	R
Default_Color	BACnetxyColor	R
Description	CharacterString	O
Default_Fade_Time	Unsigned	R
Transition	BACnetColorTransition	O
Value_Source	BACnetValueSource	O[1,2]
Audit_Level	BACnetAuditLevel	O[3]
Auditable_Operations	BACnetAuditOperationFlags	O[3]
Tags	BACnetARRAY[N] of BACnetNameValue	O
Property_List	BACnetARRAY[N] of BACnetPropertyIdentifier	R
Profile_Location	CharacterString	O
Profile_Name	CharacterString	O

[1] This property is required if the object supports the value source mechanism.
[2] This property shall be present only if the object supports the value source mechanism.
[3] This property shall be present only if the device supports audit reporting.

12.X.1 Object_Identifier

This property, of type BACnetObjectIdentifier, is a numeric code that is used to identify the object. It shall be unique within the BACnet Device that maintains it.

12.X.2 Object_Name

This property, of type CharacterString, shall represent a name for the object that is unique within the BACnet Device that maintains it. The minimum length of the string shall be one character. The set of characters used in the Object_Name shall be restricted to printable characters.

12.X.3 Object_Type

This property, of type BACnetObjectType, indicates membership in a particular object type class. The value of this property shall be COLOR.

12.X.4 Present_Value

This property, of type BACnetxyColor, shall indicate the target color value for the color output. The range of values for x and y shall be 0.0 to 1.0.

Present_Value may also be affected by writes to the Color_Command property that initiate color control commands. These commands may asynchronously affect the color output by establishing a new target for Present_Value and carrying out the requested operation. Transitioning from one color to another is supported by writing a FADE_TO_COLOR command to the property Color_Command. The current color is always indicated in the Tracking_Value property. If a color command is currently in progress and the Present_Value is written, the color command shall be halted (see Clause 12.X.6.1 Halting a Color Command in Progress).

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The color output shall be updated whenever the Present_Value is written or changed as a result of executing a color command. However, when the device starts up or is reset, it is a local matter as to whether the color output is updated with the current value of Present_Value or whether the value of the color output before startup or reset is retained (see 12.X.8). When the color output is not updated at startup or reset, the property In_Progress shall be set to NOT_CONTROLLED until the color output is updated with the current value of Present_Value. Writes to Present_Value outside of the valid range of values shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.

12.X.5 Tracking_Value

This property, of type BACnetxyColor, indicates the components of the object's actual color output. If the Color_Command is written with a color operation that affects color, causing Present_Value to be changed over time, or Present_Value is written to directly, then Tracking_Value shall indicate the calculated color for the color output from moment to moment while the fade is in progress.

When the value of In_Progress is IDLE, Tracking_Value shall be equal to Present_Value.

When the value of In_Progress is FADE_ACTIVE, Tracking_Value shall indicate the current calculated value of the fade algorithm. The manner by which the Tracking_Value is calculated in this situation shall be a local matter.

When the value of In_Progress is NOT_CONTROLLED or OTHER, the value of Tracking_Value shall be a local matter.

12.X.6 Color_Command

This property, of type BACnetColorCommand, is used to request specific behaviors. Color_Command is written with compound values that specify particular color operations. Devices containing Color objects shall support all BACnetColorOperations shown in Table 12-X2. If Color_Command 'operation' is written with an enumeration value not shown in Table 12-X2, a Result(-) shall be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE. BACnetColorOperations may include three optional fields. The 'target-color' field, of type BACnetxyColor, represents the target color for FADE_TO_COLOR operations in Color objects. The 'fade-time' field is an optional amount of time during which a fade-to-color operation occurs.

The color commands are described in Table 12-X2. The notation to specify the syntax of the color commands is as follows:

<field in angle brackets>	required field of the BACnetColorCommand
<field in angle brackets = value>	required field of the BACnetColorCommand with a specified value
[fields in square brackets]	optional fields of the BACnetColorCommand.

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Table 12-X2. Color Commands Applicable to Color Objects

Operation	Description
NONE	This operation is used to indicate that no color command has been written to the Color_Command property. This operation shall not be written to the Color_Command property. Attempts to write this operation to the Color_Command property shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.
FADE_TO_CCT RAMP_TO_CCT STEP_UP_CCT STEP_DOWN_CCT	These operations shall not be written to the Color_Command property. Attempts to write these operations to the Color_Command property shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.
FADE_TO_COLOR	Commands Present_Value to fade from the current Tracking_Value to the target-color specified in the command. The fade operation changes the color output from its current value to target-color, over a period of time defined by fade-time. While the fade operation is executing, In_Progress shall be set to FADE_ACTIVE, and Tracking_Value shall be updated to reflect the current progress of the fade. Syntax: <operation = FADE_TO_COLOR> <target-color> [fade-time]
STOP	Stops any FADE_TO_COLOR command in progress and sets In_Progress to IDLE. If there is no fade command currently executing then this operation is ignored. syntax: <operation = STOP>

12.X.6.1 Halting a Color Command in Progress

Some color commands (e.g., FADE_TO_COLOR) are executed over a period of time. While a color command is in progress, it shall be halted under the following conditions:

(k) A STOP or FADE_TO_COLOR is written to the Color_Command property, or
(l) The Present_Value is written.

When a FADE_TO_COLOR command that is currently in progress is halted, the internal fade algorithm is halted.

12.X.7 In_Progress

This property, of type BACnetColorOperationInProgress, shall indicate that there may be processes in the color object that may cause the Tracking_Value and Present_Value to differ temporarily. The processes indicated in the property are summarized in Table 12-X3.

Table 12-X3. BACnetColorOperationInProgress Values

Value	Description
IDLE	The default value that indicates that no processes are executing which would cause the Present_Value and Tracking _Value to differ.
FADE_ACTIVE	Indicates that a fade color command is currently being executed.
NOT_CONTROLLED	Indicates that on startup or reset the color output has not been updated with the current value of Present_Value.
OTHER	Indicates that the Tracking_Value and Present_Value may differ but none of the other conditions describe the nature of the process.

12.X.8 Default_Color

This property, of type BACnetxyColor, shall indicate the color to be used for the color output when the device is restarted until such time as Present_Value or Color_Command are written. As a special case, the BACnetxyColor value (0,0) for Default_Color shall be interpreted to mean “restore to previous color that was in effect prior to restart.” The Color object is not

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required to retain the moment-to-moment color value in non-volatile memory. However, if the implementation supports this feature, then Default_Color of (0,0) shall use this retained color instead of a specific default color.

12.X.9 Description

This property, of type CharacterString, is a string of printable characters whose content is not restricted.

12.X.10 Default_Fade_Time

This property, of type Unsigned, indicates the amount of time in milliseconds over which changes to the color output reflected in the Tracking_Value property of the color object shall occur when the Color_Command property is written with a fade request that does not include a fade-time value. The range of allowable fade-time values is 100 ms to 86400000 ms (1 day) inclusive.

Values written outside of the allowable range shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.

12.X.11 Transition

This property, of type BACnetColorTransition, specifies how a change in the Present_Value transitions from the current color to the target color. A transition comes into effect when the Present_Value is directly commanded. Writing the color command FADE_TO_COLOR shall ignore the Transition property.

The transition may be NONE or FADE. The transition NONE causes the Present_Value to immediately be set to the target color when Present_Value is written. The FADE transition allows a smooth transition of the color when the Present_Value changes. A FADE transition executes a fade operation from the Tracking_Value to the target color using the fade time specified in Default_Fade_Time.

When a transition results in an operation that may cause the Tracking_Value to differ from the Present_Value, then the In_Progress property shall be set to the value that reflects the operation in progress.

If the Transition property is not present, then Present_Value shall behave as if Transition is NONE.

12.X.12 Value_Source

This property, of type BACnetValueSource, indicates the source of the value of the Present_Value. The Value_Source property and its use in the value source mechanism are described in Clause 19.5.

12.X.13 Audit_Level

[Note to reviewer: see Addendum bi]

12.X.14 Auditable_Operations

[Note to reviewer: see Addendum bi]

12.X.15 Tags

This property, of type BACnetARRAY of BACnetNameValue, is a collection of tags for the object. See Clause Y.1.4 for restrictions on the string values used for the names of these tags and for a description of tagging and the mechanism by which tags are defined.

Each entry in the array is a BACnetNameValue construct which consists of the tag name and an optional value. If the tag is defined to be a "semantic tag", then it has no value, and the "value" field of the BACnetNameValue shall be absent.

While some tags may be known in advance when a device is manufactured, it is recommended that implementations consider that this kind of information might not be known until a device is deployed and to provide a means of configuration or writability of this property.

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12.X.16 Property_List

This read-only property is a BACnetARRAY of property identifiers, one property identifier for each property that exists within the object. The Object_Name, Object_Type, Object_Identifier, and Property_List properties are not included in the list.

12.X.17 Profile_Location

This property, of type CharacterString, is the URI of the location of an xdd file (See Clause X.2) containing the definition of the CSML type specified by the Profile_Name property and possible other information (See Annex X). The URI is restricted to using only the "http", "https", and "bacnet" URI schemes. See Clause Q.8 for the definition of the "bacnet" URI scheme.

If a Profile_Location value is not provided for a particular object, then the client shall use the Profile_Location of the Device object, if provided, to find the definition of the Profile_Name.

12.X.18 Profile_Name

This property, of type CharacterString, is the name of an object profile to which this object conforms. To ensure uniqueness, a profile name must begin with a vendor identifier code (see Clause 23) in base-10 integer format, followed by a dash. All subsequent characters are administered by the organization registered with that vendor identifier code. The vendor identifier code that prefixes the profile name shall indicate the organization that publishes and maintains the profile document named by the remainder of the profile name. This vendor identifier need not have any relationship to the vendor identifier of the device within which the object resides. A profile defines a set of additional properties, behavior, and/or requirements for this object beyond those specified here. This standard defines only the format of the names of profiles. The definition of the profiles themselves is outside the scope of this standard.

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135-2016*ca*-3. Add new Color Temperature object type

Rationale

The 135-2016 Lighting Output and Binary Lighting Output objects do not address the concept of color temperature in their object models. There are architectural and even commercial lighting applications, where color temperature is a useful and important concept.

These changes extend the BACnet object model to accommodate color temperature.

[Change 3.2]

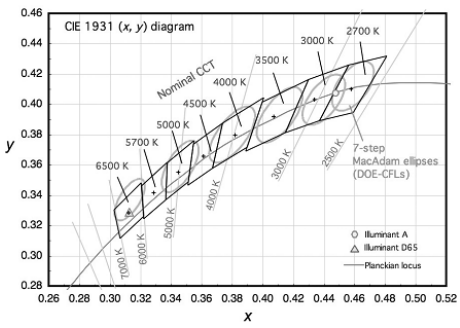
coordinated color temperature (CCT): *A concept that is defined in* ***ANSI_ANSLG C78.377-2015*** *to specify the color temperature along a white light curve through the CIE chromaticity space.*

[Add **12.Y**, Color Temperature Object Type]

12.Y Color Temperature Object Type

The Color Temperature object type defines a standardized object whose properties represent the externally visible characteristics of white light color temperature control of a color output and includes dedicated functionality specific to lighting control of color temperature that would otherwise require explicit programming. The color temperature output is analog in nature.

The color temperature of the lighting output can be changed directly to an absolute color temperature by writing to the Present_Value. The color temperature may also be changed by writing to the Color_Command property. The color command provides additional color control functionality such as fading.



The concept of closest coordinated color temperature (CCT) locus is defined in **ANSI_ANSLG C78.377-2015** (see Figure 12-Y). This idea is based on a white light curve through the CIE chromaticity space. The standard defines eight rhomboid regions centered on the white light curve. However, the curve extends to infinity and to zero within the CIE chromaticity space.

The Color Temperature object supports a single color-temperature model based on temperatures as Kelvin.

Figure 12-Y: White Light Curve

Writes of Color Temperatures that are outside the range 1000 to 10000 Kelvin shall be considered “values out of range.” When fading/ramping from one color temperature to another, the algorithm used to determine the intermediate colors shall be a local matter.

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The object and its properties are summarized in Table 12-Y and described in detail in this subclause.

Table 12-Y. Properties of the Color Temperature Object

Property Identifier	Property Datatype	Conformance Code
Object_Identifier	BACnetObjectIdentifier	R
Object_Name	CharacterString	R
Object_Type	BACnetObjectType	R
Present_Value	Unsigned	W
Tracking_Value	Unsigned	R
Color_Command	BACnetColorCommand	W
In_Progress	BACnetColorOperationInProgress	R
Default_Color_Temperature	Unsigned	R
Description	CharacterString	O
Default_Fade_Time	Unsigned	R
Default_Ramp_Rate	Unsigned	R
Default_Step_Increment	Unsigned	R
Min_Pres_Value	Unsigned	O[1]
Max_Pres_Value	Unsigned	O[1]
Transition	BACnetColorTransition	O
Value_Source	BACnetValueSource	O[2,3]
Audit_Level	BACnetAuditLevel	O[4]
Auditable_Operations	BACnetAuditOperationFlags	O[4]
Tags	BACnetARRAY[N] of BACnetNameValue	O
Property_List	BACnetARRAY[N] of BACnetPropertyIdentifier	R
Profile_Location	CharacterString	O
Profile_Name	CharacterString	O

1 If either of these properties are present, then both shall be present
2 This property is required if the object supports the value source mechanism.
3 This property shall be present only if the object supports the value source mechanism.
4 This property shall be present only if the device supports audit reporting.

12.Y.1 Object_Identifier

This property, of type BACnetObjectIdentifier, is a numeric code that is used to identify the object. It shall be unique within the BACnet Device that maintains it.

12.Y.2 Object_Name

This property, of type CharacterString, shall represent a name for the object that is unique within the BACnet Device that maintains it. The minimum length of the string shall be one character. The set of characters used in the Object_Name shall be restricted to printable characters.

12.Y.3 Object_Type

This property, of type BACnetObjectType, indicates membership in a particular object type class. The value of this property shall be COLOR_TEMPERATURE.

12.Y.4 Present_Value

This property, of type Unsigned, shall indicate the target Color Temperature in Kelvin for the color temperature output. The range of values shall be 1000 to 10000 Kelvin. When writing to Present_Value, the algorithm used to determine the closest supported color temperature shall be a local matter.

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Present_Value may also be affected by writes to the Color_Command property that initiate color commands. These commands may asynchronously affect the color temperature output by establishing a new target for Present_Value and carrying out the requested operation. Transitioning from one color temperature to another is supported by writing a FADE_TO_CCT, RAMP_TO_CCT, STEP_UP_CCT, or STEP_DOWN_CCT command to the property Color_Command. The current color temperature is always indicated in the Tracking_Value property. If a color command is currently in progress and the Present_Value is written, the color command shall be halted (see Clause 12.Y.6.1 Halting a Color Command in Progress).

The color temperature output shall be updated whenever the Present_Value is written or changed as a result of executing a color command. However, when the device starts up or is reset, it is a local matter as to whether the color temperature output is updated with the current value of Present_Value or whether the value of the color temperature output before startup or reset is retained (see 12.Y.8). When the color temperature output is not updated at startup or reset, the property In_Progress shall be set to NOT_CONTROLLED until the color temperature output is updated with the current value of Present_Value.

If the Min_Pres_Value and Max_Pres_Value properties are present, then writes to Present_Value shall be further restricted to the range Min_Pres_Value through Max_Pres_Value. Values greater than 1000 and less than Min_Pres_Value shall be clamped to Min_Pres_Value. Values greater than Max_Pres_Value and less than 10000 shall be clamped to Max_Pres_Value.

If the Min_Pres_Value and Max_Pres_Value properties are not present, then writes to Present_Value outside of the valid range of values shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.

12.Y.5 Tracking_Value

This property, of type Unsigned, indicates the device’s actual light output color temperature in Kelvin. If the Color_Command is written with a color operation that affects color temperature, causing Present_Value to be changed over time, or Present_Value is written-to directly, then Tracking_Value shall indicate the calculated color temperature for the color temperature output from moment to moment while the fade is in progress.

When the value of In_Progress is IDLE, Tracking_Value shall be equal to Present_Value.

When the value of In_Progress is FADE_ACTIVE or RAMP_ACTIVE, Tracking_Value shall indicate the current calculated value of the fade/ramp algorithm. The manner by which the Tracking_Value is calculated in this situation shall be a local matter.

When the value of In_Progress is NOT_CONTROLLED or OTHER, the value of Tracking_Value shall be a local matter.

12.Y.6 Color_Command

This property, of type BACnetColorCommand, is used to request color commands with specific behaviors. Color_Command is written with compound values that specify particular color operations. Devices containing Color Temperature objects shall support all BACnetColorOperations shown in Table 12-Y2. If Color_Command is written with an enumeration value not shown in Table 12-Y2, a Result(-) shall be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE. If Color_Command is written with the value FADE_TO_COLOR, a Result(-) shall be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE. The 'target-color-temperature' field, of type Unsigned, represents the target color temperature in Kelvin for FADE_TO_CCT and RAMP_TO_CCT operations in Color Temperature objects. The 'fade-time' field is an optional amount of time during which the fade operation occurs for FADE_TO_CCT operations. The 'ramp-rate' field is an optional rate of change per second during ramp operation for RAMP_TO_CCT operations. The 'step-increment' field is an optional amount that Present_Value is incremented or decremented for each STEP_UP_CCT or STEP_DOWN_CCT operation. If a BACnetColorCommand is sent that includes an optional field that is not explicitly described for that operation in Table 12-Y2, then the field value shall be ignored. Color commands written with a required or optional field, explicitly specified for this command, which are outside of the allowable range of values, shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.

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The color commands are described in Table 12-Y2. The notation to specify the syntax of the color commands is as follows:

<field in angle brackets>	required field of the BACnetColorCommand
<field in angle brackets = value>	required field of the BACnetColorCommand with a specified value
[fields in square brackets]	optional fields of the BACnetColorCommand.

Table 12-Y2. Color Commands Applicable to Color Temperature Objects

Operation	Description
NONE	This operation is used to indicate that no color command has been written to the Color_Command property. This operation shall not be written to the Color_Command property. Attempts to write this operation to the Color_Command property shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.
FADE_TO_COLOR	This operation shall not be written to the Color_Command property. Attempts to write this operation to the Color_Command property shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.
FADE_TO_CCT	Commands Present_Value to fade from the current Tracking_Value to the target-color-temperature specified in the command. The fade operation changes the output color temperature from its current value to target-color-temperature, over a period of time defined by fade-time. While the fade operation is executing, In_Progress shall be set to FADE_ACTIVE, and Tracking_Value shall be updated to reflect the current progress of the fade. <target-color-temperature> shall be clamped to Min_Pres_Value and Max_Pres_Value as described in 12.Y.4. syntax: <operation = FADE_TO_CCT> <target-color-temperature> [fade-time]
RAMP_TO_CCT	Commands Present_Value to ramp from the current Tracking_Value to the target-color-temperature specified in the command. The ramp operation changes the output color temperature from its current value to target-color-temperature, at a particular Kelvin per second defined by ramp-rate. While the ramp operation is executing, In_Progress shall be set to RAMP_ACTIVE, and Tracking_Value shall be updated to reflect the current progress of the fade. <target-color-temperature> shall be clamped to Min_Pres_Value and Max_Pres_Value as described in 12.Y.4. syntax: <operation = RAMP_TO_CCT> <target-color-temperature> [ramp-rate]
STEP_UP_CCT	Commands Present_Value to a value equal to the Tracking_Value plus the step-increment. The resulting sum shall be clamped to Min_Pres_Value and Max_Pres_Value as described in 12.Y.4. syntax: <operation = STEP_UP_CCT> [step-increment]
STEP_DOWN_CCT	Commands Present_Value to a value equal to the Tracking_Value minus the step-increment. The resulting difference shall be clamped to Min_Pres_Value and Max_Pres_Value as described in 12.Y.4. syntax: <operation = STEP_DOWN_CCT> [step-increment]
STOP	Stops any FADE_TO_CCT or RAMP_TO_CCT command in progress and sets In_Progress to IDLE. If there is no fade command currently executing then this operation is ignored. syntax: <operation = STOP>

12.Y.6.1 Halting a Color Command in Progress

Some color commands (e.g., FADE_TO_CCT) are executed over a period of time. While a color command is in progress, it shall be halted under the following conditions:

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(a) A STOP or FADE_TO_CCT or RAMP_TO_CCT or STEP_UP_CCT or STEP_DOWN_CCT is written to the Color_Command property, or
(b) The Present_Value is written.

When a FADE_TO_CCT or RAMP_TO_CCT or STEP_UP_CCT or STEP_DOWN_CCT command that is currently in progress is halted, the internal fade/ramp algorithm is halted.

12.Y.7 In_Progress

This property, of type BACneColorOperationInProgress, shall indicate that there may be processes in the Color Temperature object that may cause the Tracking_Value and Present_Value to differ temporarily. The processes indicated in the property are summarized in Table 12-Y3.

Table 12-Y3. BACnetColorOperationInProgress Values

Value	Description
IDLE	The default value that indicates that no processes are executing which would cause the Present_Value and Tracking _Value to differ.
FADE_ACTIVE	Indicates that a fade-to-cct command is currently being executed.
RAMP_ACTIVE	Indicates that a ramp-to-cct command is currently being executed.
NOT_CONTROLLED	Indicates that on startup or reset the color temperature output has not been updated with the current value of Present_Value.
OTHER	Indicates that the Tracking_Value and Present_Value may differ but none of the other conditions describe the nature of the process.

12.Y.8 Default_Color_Temperature

This property, of type Unsigned, shall indicate the color temperature in Kelvin to be used for the Color Temperature when the device is restarted until such time as Present_Value or Color_Command are written. The Color Temperature object is not required to retain the moment-to-moment Color Temperature in non-volatile memory.

Writes to Default_Color_Temperature shall be clamped to Min_Pres_Value and Max_Pres_Value as described in 12.Y.4.

12.Y.9 Description

This property, of type CharacterString, is a string of printable characters whose content is not restricted.

12.Y.10 Default_Fade_Time

This property, of type Unsigned, indicates the amount of time in milliseconds over which changes to the Color Temperature reflected in the Tracking_Value property shall occur when the Color_Command property is written with a fade request that does not include a fade-time value. The range of allowable fade-time values is 100 ms to 86400000 ms (1 day) inclusive.

Values written outside of the allowable range shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.

12.Y.11 Default_Ramp_Rate

This property, of type Unsigned, indicates the rate of change, in Kelvin per second, to the Color Temperature reflected in the Tracking_Value property that shall occur when the Color_Command property is written with a ramp request that does not include a ramp-rate value. The range of allowable ramp-rate values is 1 to 10000 inclusive.

Values written outside of the allowable range shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.

12.Y.12 Default_Step_Increment

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This property, of type Unsigned, indicates the amount of change in Kelvin to the Color Temperature reflected in the Tracking_Value property that shall occur when the Color_Command property is written with a step-up or step-down request that does not include a step-increment value. The range of allowable step-Increment values is 1 to 10000 inclusive.

Values written outside of the allowable range shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.

12.Y.13 Min_Pres_Value

This property, of type Unsigned, specifies the minimum value allowed for Present_Value. Writes to Present_Value shall be clamped to the range Min_Pres_Value to Max_Pres_Value. See 12.Y.4. Min_Pres_Value shall be greater than or equal to 1000.

12.Y.14 Max_Pres_Value

This property, of type Unsigned, specifies the maximum value allowed for Present_Value. Writes to Present_Value shall be clamped to the range Min_Pres_Value to Max_Pres_Value. See 12.Y.4. Max_Pres_Value shall be less than or equal to 10000.

12.Y.15 Transition

This property, of type BACnetColorTransition, specifies how a change in the Present_Value transitions from the current level to the target level. A transition comes into effect when the Present_Value is directly commanded. Writing the Color command FADE_TO_CCT, RAMP_TO_CCT, STEP_UP_CCT, or STEP_DOWN_CCT shall ignore the Transition property.

The transition may be NONE or FADE or RAMP. The transition NONE causes the Present_Value to immediately be set to the target level when Present_Value is written. The FADE transition allows a smooth transition of the color temperature when the Present_Value changes. A FADE transition executes a fade operation from the Tracking_Value to the target level using the fade time specified in Default_Fade_Time. The RAMP transition also allows a smooth transition of the color temperature when the Present_Value changes. A RAMP transition executes a ramp operation from the Tracking_Value to the target level using the ramp-rate specified in Default_Ramp_Rate.

When a transition results in an operation that may cause the Tracking_Value to differ from the Present_Value, then the In_Progress property shall be set to the value that reflects the operation in progress.

If the Transition property is not present, then Present_Value shall behave as if Transition is NONE.

12.Y.16 Value_Source

This property, of type BACnetValueSource, indicates the source of the value of the Present_Value. The Value_Source property and its use in the value source mechanism are described in Clause 19.5.

12.Y.17 Audit_Level

[Note to reviewer: see Addendum bi]

12.Y.18 Auditable_Operations

[Note to reviewer: see Addendum bi]

12.Y.19 Tags

This property, of type BACnetARRAY of BACnetNameValue, is a collection of tags for the object. See Clause Y.1.4 for restrictions on the string values used for the names of these tag and for a description of tagging and the mechanism by which tags are defined.

Each entry in the array is a BACnetNameValue construct which consists of the tag name and an optional value. If the tag is defined to be a "semantic tag", then it has no value, and the "value" field of the BACnetNameValue shall be absent.

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While some tags may be known in advance when a device is manufactured, it is recommended that implementations consider that this kind of information might not be known until a device is deployed and to provide a means of configuration or writability of this property.

12.Y.20 Property_List

This read-only property is a BACnetARRAY of property identifiers, one property identifier for each property that exists within the object. The Object_Name, Object_Type, Object_Identifier, and Property_List properties are not included in the list.

12.Y.21 Profile_Location

This property, of type CharacterString, is the URI of the location of an xdd file (See Clause X.2) containing the definition of the CSML type specified by the Profile_Name property and possible other information (See Annex X). The URI is restricted to using only the "http", "https", and "bacnet" URI schemes. See Clause Q.8 for the definition of the "bacnet" URI scheme.

If a Profile_Location value is not provided for a particular object, then the client shall use the Profile_Location of the Device object, if provided, to find the definition of the Profile_Name.

12.Y.22 Profile_Name

This property, of type CharacterString, is the name of an object profile to which this object conforms. To ensure uniqueness, a profile name must begin with a vendor identifier code (see Clause 23) in base-10 integer format, followed by a dash. All subsequent characters are administered by the organization registered with that vendor identifier code. The vendor identifier code that prefixes the profile name shall indicate the organization that publishes and maintains the profile document named by the remainder of the profile name. This vendor identifier need not have any relationship to the vendor identifier of the device within which the object resides. A profile defines a set of additional properties, behavior, and/or requirements for this object beyond those specified here. This standard defines only the format of the names of profiles. The definition of the profiles themselves is outside the scope of this standard.

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135-2016*ca*-4. Add color-reference properties to LO and BLO object types

Rationale

The 135-2016 Lighting Output (LO) and Binary Lighting Output (BLO) objects only affect luminance of lighting output. The newly proposed Color (135-2016ca-2) and Color Temperature (135-2016ca-3) objects provide control of color and color temperature. When a lighting output device needs to control both luminance and color or color temperature, there is no obvious connection between the LO or BLO object and its color-describing companion object. Further, there are use cases for color and color temperature control that require explicit override of color temporarily.

These changes introduce new properties to LO and BLO objects that expose those relationships.

[Change **12.54**, Lighting Output Object Type]

…

Figure 12-14. Daily Schedule with Blink-Warn Example

In some cases, lighting outputs may also need to control color or color temperature of the physical device that the output represents. In those instances, the color characteristics of the physical output are controlled by companion Color or Color Temperature objects. The Color_Reference property defines the companion Color or Color Temperature object. Multiple Lighting Output objects may reference the same Color or Color Temperature object when required.

When there are companion color objects, they operate asynchronously with respect to the Lighting Output object. That can create circumstances that need special handling. For example, a physical output is producing a dim light of a specific color. During an emergency or maintenance situation, that output might need to be changed to a bright white light instead and then after the situation is resolved, the output should return to its previous state. However, when there is a companion color object that is asynchronously performing a transition such as a FADE operation, upon restoration, the color should return to the then-current color, not the color that existed at the start of the emergency. The Override_Color_Reference property defines a Color or Color Temperature object to be used as the color during an override situation.

The object and its properties are summarized in Table 12-64 and described in detail in this clause.

…

[Add to Table 12-64]

…

Command_Time_Array	BACnetARRAY[16] of BACnetTimeStamp	O[7]
Color_Reference	*BACnetObjectIdentifier*	*O[x]*
Color_Override	*Boolean*	*O[y]*
Override_Color_Reference	*BACnetObjectIdentifier*	*O[y]*
Tags	BACnetARRAY[N] of BACnetNameValue	O
Profile_Location	CharacterString	O
Profile_Name	CharacterString	O

…

[8] This property shall be writable as described in Clause **Error! Reference source not found.**~~19.5~~.

[x] *This property is required if the object supports color or color override*

[y] *This property is required if, and shall be present only if, the object supports color override*

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[Add 12.54.X, 12.54.Y, and 12.54.Z]

12.54.X Color_Reference

This property, of type BACnetObjectIdentifier, when present, shall specify the object identifier of a Color or Color Temperature object that controls the color aspects of this Lighting Output. If the object instance portion of the object identifier has the value 4194303, then there is no color companion object associated with this output. In that case, the applicable color or color temperature shall be a local matter.

12.54.Y Color_Override

This property, of type Boolean, when present, shall specify whether the currently active color or color temperature comes from the Color_Reference (FALSE) or Override_Color_Reference (TRUE). If Color_Override is present, it shall be writable.

12.54.Z Override_Color_Reference

This property, of type BACnetObjectIdentifier, when present, shall specify the object identifier of a Color or Color Temperature object that controls the color override aspects of this Lighting Output. Color override occurs when the Color_Override property of the Lighting Output is written with TRUE. In this case, the Override_Color_Reference points to an object whose color shall be used to control the actual color of the lighting output. While color-overridden, any fade that may be in progress for the lighting output, as well as any fade that may be in progress for the Color_Reference object, shall continue without interruption, except that the actual color output shall use the override color instead. Color override shall cease when Color_Override is written with FALSE.

If the object instance portion of the object identifier has the value 4194303, then there is no color companion override object associated with this output. In that case, the applicable color or color temperature shall be a local matter.

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[Change **12.55**, Binary Lighting Output Object Type]

…

Figure 12-16. Daily Schedule with Blink-Warn Example

In some cases, binary lighting outputs may also need to control color or color temperature of the physical device that the output represents. In those instances, the color characteristics of the physical output are controlled by companion Color or Color Temperature objects. The Color_Reference property defines the companion Color or Color Temperature object. Multiple Binary Lighting Output objects may reference the same Color or Color Temperature object when required.

When there are companion color objects, they operate asynchronously with respect to the Binary Lighting Output object. That can create circumstances that need special handling. For example, a physical output is producing a light of a specific color. During an emergency or maintenance situation, that output might need to be changed to a bright white light instead and then after the situation is resolved, the output should return to its previous state. However, when there is a companion color object that is asynchronously performing a transition such as a FADE operation, upon restoration, the color should return to the then-current color, not the color that existed at the start of the emergency. The Override_Color_Reference property defines a Color or Color Temperature object to be used as the color during an override situation.

The object and its properties are summarized in Table 12-69 and described in detail in this clause.

…

[Add to Table 12-69]

…

Command_Time_Array	BACnetARRAY[16] of BACnetTimeStamp	O[7]
Color_Reference	*BACnetObjectIdentifier*	*O[x]*
Color_Override	*Boolean*	*O[y]*
Override_Color_Reference	*BACnetObjectIdentifier*	*O[y]*
Tags	BACnetARRAY[N] of BACnetNameValue	O
Profile_Location	CharacterString	O
Profile_Name	CharacterString	O

…

[8] This property shall be writable as described in Clause **Error! Reference source not found.**~~19.5~~.

[x] *This property is required if the object supports color or color override*

[y] *This property is required if, and shall be present only if, the object supports color override*

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[Add 12.55.X, 12.55.Y, and 12.55.Z]

12.55.X Color_Reference

This property, of type BACnetObjectIdentifier, when present, shall specify the object identifier of a Color or Color Temperature object that controls the color aspects of this Binary Lighting Output. If the object instance portion of the object identifier has the value 4194303, then there is no color companion object associated with this output. In that case, the applicable color or color temperature shall be a local matter.

12.55.Y Color_Override

This property, of type Boolean, when present, shall specify whether the currently active color or color temperature comes from the Color_Reference (FALSE) or Override_Color_Reference (TRUE). If Color_Override is present, it shall be writable.

12.55.Z Override_Color_Reference

This property, of type BACnetObjectIdentifier, when present, shall specify the object identifier of a Color or Color Temperature object that controls the color override aspects of this Binary Lighting Output. Color override occurs when the Color_Override property of the Binary Lighting Output is written with TRUE. In this case, the Override_Color_Reference points to an object whose color shall be used to control the actual color of the lighting output. While color-overridden, any fade that may be in progress for the Color_Reference object shall continue without interruption, except that the actual color output shall use the override color instead. Color override shall cease when Color_Override is written with FALSE.

If the object instance portion of the object identifier has the value 4194303, then there is no color companion override object associated with this output. In that case, the applicable color or color temperature shall be a local matter.

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135-2016ca-5. Add high/low trim to LO object type

[change Clause 12.54, p. 495]

12.54 Lighting Output Object Type

…

The physical output level, or non-normalized range, is specified as the linearized percentage (0..100%) of the possible light output range with 0.0% being off, 1.0% being dimmest, and 100.0% being brightest. The actual range represents the subset of physical output levels defined by Min_Actual_Value and Max_Actual_Value (or 1.0 to 100.0% if these properties are not present). The normalized range is always 0.0 to 100.0% where 1.0% = bottom of the actual range and 100.0% = top of the actual range. All 0.0% to 100.0% properties of the Lighting Output object shall use the normalized range except for Min_Actual_Value and Max_Actual_Value. If Min_Actual_Value and Max_Actual_Value are not present, then the normalized and non-normalized ranges shall be the same.

The Operating Range is a subset of the Normalized Range that represents the range of acceptable values for control of the object. This range is defined by the High_End_Trim and Low_End_Trim property values. When values are written outside of the Operating Range, the Tracking_Value will reflect the actual, clamped normalized light output while the Present_Value will reflect the original target value.

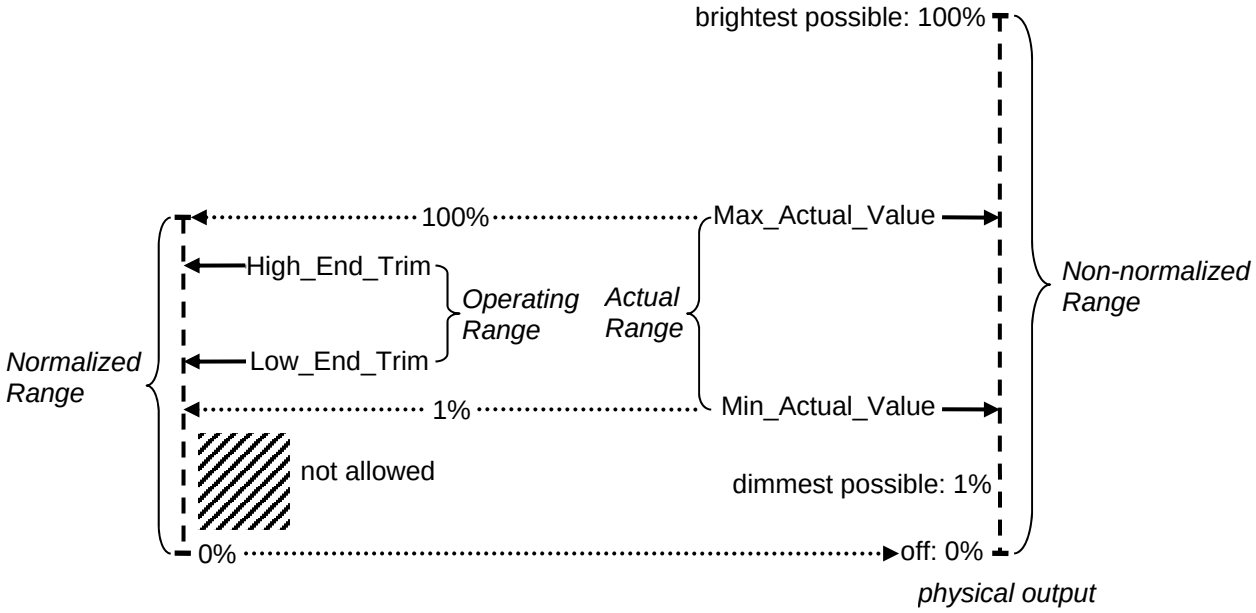

Figure 12-13. Normalized Range and Operating Range of the Lighting Output

…

The object and its properties are summarized in Table 12-64 and described in detail in this clause.

Table 12-64. Properties of the Lighting Output Object Type

Property Identifier	Property Datatype	Conformance Code
…	…	
Profile_Name	CharacterString	O
High_End_Trim	*REAL*	*O*
Low_End_Trim	*REAL*	*O*
Trim_Fade_Time	*Unsigned*	*O*[n1]

…

[n1] *This property is required if and only if either the High_End_Trim or Low_End_Trim properties are present.*

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[change Clause 12.54.5, p. 498]

12.54.5 Tracking_Value
This property, of type REAL, indicates the value at which the physical lighting output is being controlled within the normalized range at all times. *If the High_End_Trim or Low_End_Trim properties are present, the Tracking_Value shall be clamped inclusively within the Operating Range.*

When the value of In_Progress is IDLE, Tracking_Value shall be equal to Present_Value.

When the value of In_Progress is RAMP_ACTIVE or FADE_ACTIVE, Tracking_Value shall indicate the current calculated value of the ramp or fade algorithm. The manner by which the Tracking_Value is calculated in this situation shall be a local matter.

When the value of In_Progress is TRIM_ACTIVE, Tracking_Value shall indicate the clamped value equal to either the High_End_Trim or Low_End_Trim properties.

When the value of In_Progress is NOT_CONTROLLED or OTHER, the value of Tracking_Value shall be a local matter.

[change Table 12-68, p. 503]

12.54.7 In_Progress
…

Table 12-68. BACnetLightingInProgress Values

Value	Description
IDLE	The default value that indicates that no ~~processes are executing~~ *condition is in effect*, which would cause the Present_Value and Tracking _Value to differ.
RAMP_ACTIVE	Indicates that a ramp lighting command is currently being executed.
FADE_ACTIVE	Indicates that a fade lighting command is currently being executed.
TRIM_ACTIVE	*Indicates that the Present_Value is currently outside of the Operating Range (lower than Low_End_Trim or higher than High_End_Trim) regardless of ramp or fade status, which would cause the Present_Value and Tracking_Value to differ.*
NOT_CONTROLLED	Indicates that on startup or reset the physical output has not been updated with the current value of Present_Value.
OTHER	Indicates that the Tracking_Value and Present_Value may differ but none of the other conditions describe the nature of the process.

[add new Clauses 12.54.Yn, p. 507]

12.54.Y1 High_End_Trim
This property, of type REAL, specifies a physical lighting output value within the normalized range that acts as an upper-end limit for the Tracking_Value. High_End_Trim can be equal to Max_Actual_Value. This property does not change the normalized range. If the Present_Value is written with a value above the High_End_Trim, the Tracking_Value shall be clamped to High_End_Trim.

Changing High_End_Trim to a value less than Low_End_Trim shall force Low_End_Trim to become equal to High_End_Trim. High_End_Trim shall always be a positive number in the range 1.0% to 100.0%.

When High_End_Trim is being used and the value of the In_Progress property is TRIM_ACTIVE, the method for adjusting the calculation of fade-time shall be a local matter.

If Present_Value is commanded at priority 1 or 2, High_End_Trim shall not be applied, and the Tracking_Value will not be clamped.

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12.54.Y2 Low_End_Trim

This property, of type REAL, specifies a physical lighting output value within the normalized range that acts as a lower-end limit for the Tracking_Value. Low_End_Trim can be equal to Min_Actual_Value. This property does not change the normalized range. If the Present_Value is written with a value above 0.0% but below the Low_End_Trim, the Tracking_Value shall be clamped to Low_End_Trim.

Changing Low_End_Trim to a value higher than High_End_Trim shall force High_End_Trim to become equal to Low_End_Trim. Low_End_Trim shall always be a positive number in the range 1.0% to 100.0%.

When Low_End_Trim is being used and the value of the In_Progress property is TRIM_ACTIVE, the method for adjusting the calculation of fade-time shall be a local matter.

If Present_Value is commanded at priority 1 or 2, Low_End_Trim shall not be applied, and the Tracking_Value will not be clamped.

12.54.Y3 Trim_Fade_Time

This property, of type Unsigned, indicates the amount of time in milliseconds over which changes to the normalized value reflected in the Tracking_Value property of the lighting output shall occur when the High_End_Trim or Low_End_Trim properties are changed such that the current value of the Present_Value property falls outside of the Operating Range. The range of allowable fade-time values is 0 ms to 86400000 ms (1 day) inclusive.

Values written outside of the allowable range shall cause a Result(-) to be returned with an Error Class of PROPERTY and an Error Code of VALUE_OUT_OF_RANGE.

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135-2016*ca*-6. Aggregated changes to Clause 21 and 25

[Clause 21 changes]

BACnetChannelValue ::= CHOICE {

null	NULL,
real	REAL,
enumerated	ENUMERATED,
unsigned	Unsigned,
boolean	BOOLEAN,
integer	INTEGER,
double	Double,
time	Time,
characterstring	CharacterString,
octetstring	OCTET STRING,
bitstring	BIT STRING,
date	Date,
objectidentifier	BACnetObjectIdentifier,
lighting-command	[0] BACnetLightingCommand,
xycolor	*[n] BACnetxyColor*
color-command	*[n+1] BACnetColorCommand*

}

BACnetColorCommand ::= SEQUENCE {

operation	[0] BACnetColorOperation,
target-color	[1] BACnetxyColor OPTIONAL,
target-color-temperature	[2] Unsigned OPTIONAL,
fade-time	[3] Unsigned (100.. 86400000) OPTIONAL,
ramp-rate	[4] Unsigned (1..10000) OPTIONAL,
step-increment	[5] Unsigned (1..10000) OPTIONAL

}

BACnetColorOperationInProgress ::= ENUMERATED {

idle	(0),
fade-active	(1),
ramp-active	(2),
not-controlled	(3),
other	(4)

}

BACnetColorTransition ::= ENUMERATED {

none	(0),
fade	(1),
ramp	(2)

}

BACnetxyColor::= SEQUENCE {

x-coordinate	REAL,	--(0.0 to 1.0)
y-coordinate	REAL	--(0.0 to 1.0)

}

BACnetLightingInProgress ::= ENUMERATED {

idle (0),
fade-active (1),
ramp-active (2),
not-controlled (3),
~~other (4)~~

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other(4),
trim-active (n)
}

BACnetPriorityValue ::= CHOICE {
null NULL,
real REAL,
enumerated ENUMERATED,
unsigned Unsigned,
boolean BOOLEAN,
signed INTEGER,
double Double,
time Time,
characterString CharacterString,
octetString OCTET STRING,
bitString BIT STRING,
date Date,
objectid BACnetObjectIdentifier,
constructedValue [0] ABSTRACT-SYNTAX.&Type,
datetime [1] BACnetDateTime,
xycolor *[n] BACnetxyColor*
}

BACnetColorOperation ::= ENUMERATED {
none (0),
fade-to-color (1),
fade-to-cct (2),
ramp-to-cct (3),
step-up-cct (4),
step-down-cct (5),
stop (6)
}

[Insert into production **BACnetPropertyIdentifier** in **Clause 21**, p. 845]

BACnetPropertyIdentifier ::= ENUMERATED { -- see below for numerical order
. . .
client-cov-increment (127),
color-override *(n)*,
color-reference *(n+1)*,
default-color *(n+2)*,
default-color-temperature *(n+3)*,
. . .
output-units (82),
override-color-reference *(n+4)*
. . .
-- numerical order reference
. . .
-- see represents (491),
-- *see color-override* *(n)*,
-- *see color-reference* *(n+1)*,
-- *see default-color* *(n+2)*,
-- *see default-color-temperature* *(n+3)*,
-- *see override-color-reference* *(n+4)*

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[Add to Clause 25]

***CIE 13.3-1995**, Commission Internationale de l'Eclairage, Method of Measuring and Specifying Colour Rendering of Light Sources.*

***CIE 15: 2004**, Commission Internationale de l'Eclairage, Colorimetry, 3rd edition.)*

***ANSI_ANSLG C78.377-2015**, Specifications for the Chromaticity of Solid State Lighting Products.*

[Add a new entry to **History of Revisions**, p. 1364]

HISTORY OF REVISIONS

. . .	. . .	. . .
1	X	Addendum ca to ANSI/ASHRAE Standard 135-2016 Approved by ASHRAE on MONTH DAY, 20XX; and by the American National Standards Institute on MONTH DAY, 20XX. 1. Add new Color object type. 2. Add new Color Temperature object type. 3. Add color-reference properties to LO and BLO object types. 4. Add high/low trim to LO object type

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