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Matter Application Cluster Specification

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Abstract: The Matter Application Clusters specified in this document are generic interfaces that are sufficiently general to be of use across a wide range of application domains.

Keywords: Referenced in Chapter 1.

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Matter Application Clusters

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Introduction

The Matter Application Cluster specification defines generic interfaces that are sufficiently general to be of use across a wide range of application domains.

Scope and Purpose

This document specifies the Matter Application Cluster Library (MACL). The MACL is a repository for cluster functionality that is developed by the Connectivity Standards Alliance, and is a working library with regular updates as new functionality is added. A developer constructing a new application should use the MACL to find relevant cluster functionality that can be incorporated into the new application. Correspondingly, new clusters that are defined for applications should be considered for inclusion in the MACL.

The MACL consists of a number of sets of clusters. Clusters that are generally useful across many application domains are included in the General set. Clusters that are intended for use mainly in specific application domains are grouped together in domain oriented sets.

References

The following standards and specifications contain provisions, which through reference in this document constitute provisions of this specification. All the standards and specifications listed are normative references. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the standards and specifications indicated below.

CSA Reference Documents

Reference	Reference Location/URL	Description
[MatterCore]	https://github.com/CHIP-Specifications/connected-homeip-spec/raw/build-sample/pdf/main.pdf	Matter Core Specification - Under development
[MatterDevLib]	https://github.com/CHIP-Specifications/connected-homeip-spec/raw/build-sample/pdf/device_library.pdf	Matter Device Library Specification - Under development
[CSA-PNP]	https://groups.csa-iot.org/wg-members/document/21624	Organizational Processes and Procedures, 13-0625, revision 8, November 2021

External Reference Documents

Reference	Reference Location/URL	Description
[DIALRegistry]	http://www.dial-multi-screen.org/dial-registry/namespace-database	DIAL Registry
[HDMI]	https://hdmiforum.org/hdmi-forum-releases-version-2-1-hdmi-specification/	HDMI CEC specification
[WakeOn-LAN]	https://www.amd.com/system/files/TechDocs/20213.pdf	Wake on LAN Magic Packet specification

Provisional

Per [CSA-PNP], when a specification is completed there may be sections of specification text (or smaller pieces of a section) that are not certifiable at this stage. These sections (or smaller pieces of a section) are marked as provisional prior to publishing the specification. This specification uses well-defined notation to mark Provisional Conformance (see [MatterCore], Section 7.3) or notes a section of text with the term "provisional".

List of Provisional Items

The following is a list of provisional items:

- Support for [Scenes cluster](#) is provisional.
- Support for Pulse Width Modulation cluster and for the Frequency feature of the [Level control cluster](#) is provisional
- Support for [Ballast Configuration Cluster](#) is provisional.
- Support for [Fan Control cluster](#) is provisional.

Chapter 1. General

The Cluster Library is made of individual chapters such as this one. See Document Control in the Cluster Library for a list of all chapters and documents. References between chapters are made using a *X.Y* notation where *X* is the chapter and *Y* is the sub-section within that chapter. References to external documents are contained in Chapter 1 and are made using [Rn] notation.

1.1. General Description

1.1.1. Introduction

The clusters specified in this document are generic interfaces that are sufficiently general to be of use across a wide range of application domains.

1.1.2. Cluster List

This section lists the general clusters as specified in this chapter.

Table 1. Overview of the General Clusters

ID	Cluster Name	Description
0x0003	Identify	Attributes and commands for putting a device into Identification mode (e.g., flashing a light)
0x0004	Groups	Cluster to manage the associated endpoint's membership into one or more groups to support groupcast interactions.
0x0005	Scenes	Attributes and commands for setting up and recalling a number of scenes for a device. Each scene corresponds to a set of stored values of specified device attributes.
0x0006	On/Off	Attributes and commands for switching devices between 'On' and 'Off' states.
0x0008	Level Level Control for Lighting	Attributes and commands for controlling a characteristic of devices that can be set to a level between fully 'On' and fully 'Off'.
0x0045	Boolean State	Attribute and event for a boolean state variable

ID	Cluster Name	Description
0x0050	Mode Select	Allows a user to choose one mode option from several pre-defined values
0x0508	Low Power	This cluster provides an interface for managing low power mode on a device.
0x0503	Wake On LAN	This cluster provides an interface for managing low power mode on a device that supports the Wake On LAN protocol.
0x003b	Switch	Attributes and events for various types of switch devices.

1.2. Identify

This cluster supports an endpoint identification state (e.g., flashing a light), that indicates to an observer (e.g., an installer) which of several nodes and/or endpoints it is. It also supports a multi-cast request that any endpoint that is identifying itself to respond to the initiator.

The state of this cluster MAY be shared on more than one endpoint on a node.

For Example: Two endpoints on a single node, one a temperature sensor, and one a humidity sensor, may both share the same cluster instance and therefore identification state (e.g. single LED on the node).

Zigbee: Note that this cluster cannot be disabled, and remains functional regardless of the setting of the DeviceEnable attribute in the Basic cluster.

1.2.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	global mandatory ClusterRevision attribute added
2	CCB 2808
3	All Hubs changes
4	new data model format and notation

1.2.2. Classification

Hierarchy	Role	PICS Code
Base	Utility	I

1.2.3. Cluster Identifiers

Identifier	Name
0x0003	Identify

1.2.4. Features

This cluster SHALL support the Feature Map global attribute with these bits defined:

Bit	Code	Name	Description
0	QRY	Query	Multicast query for identification state

1.2.4.1. Query Feature

This feature supports a unicast, groupcast or multicast query of the cluster state, with a response back to query initiator, if the identification state is active. This feature is supported for underlying stacks that support a response to a multicast or groupcast command.

1.2.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Identify-Time	uint16	all		0	RW VO	M
0x0001	Identify-Type	enum8	desc		0	R V	M*

* IdentifyType represents a mandatory attribute that was previously not present or optional. Implementers should be aware that older devices may not implement it.

1.2.5.1. IdentifyTime Attribute

This attribute specifies the remaining length of time, in seconds, that the endpoint will continue to identify itself.

If this attribute is set to a value other than 0 then the device SHALL enter its identification state, in order to indicate to an observer which of several nodes and/or endpoints it is. It is RECOMMENDED that this state consists of flashing a light with a period of 0.5 seconds. The IdentifyTime attribute SHALL be decremented every second while in this state.

If this attribute reaches or is set to the value 0 then the device SHALL terminate its identification state.

1.2.5.2. IdentifyType Attribute

This attribute specifies how the identification state is presented to the user.

This field SHALL contain one of the values listed below:

Table 2. Values of the IdentifyType attribute

Value	Presentation	Notes
0x00	None	No presentation.
0x01	Light output	Light output of a lighting product.
0x02	Visible indicator	Typically a small LED.
0x03	Audible beep	
0x04	Display	Presentation will be visible on display screen.
0x05	Actuator	Presentation will be conveyed by actuator functionality such as through a window blind operation or in-wall relay.

1.2.6. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	Identify	client ⇒ server	Y	M	M
0x01	IdentifyQuery	client ⇒ server	Identify-QueryResponse	M	QRY
0x40	TriggerEffect	client ⇒ server	Y	M	O
0x00	Identify-QueryResponse	server ⇒ client	N		QRY

1.2.6.1. Identify Command

This command starts or stops the receiving device identifying itself.

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	IdentifyTime	uint16	all			M

1.2.6.1.1. Effect on Receipt

On receipt of this command, the device SHALL set the IdentifyTime attribute to the value of the IdentifyTime field. This then starts, continues, or stops the device's identification state as detailed in [IdentifyTime Attribute](#).

1.2.6.2. IdentifyQuery Command

This command allows the sending device to request the target or targets to respond if they are currently identifying themselves.

This command has no data fields.

1.2.6.2.1. Effect on Receipt

On receipt of this command, if the IdentifyTime attribute is not zero, then it SHALL generate a response in the form of an IdentifyQueryResponse command, see [IdentifyQueryResponse Command](#). Otherwise it SHALL take no further action.

1.2.6.3. TriggerEffect Command

This command allows the support of feedback to the user, such as a certain light effect. It is used to allow an implementation to provide visual feedback to the user under certain circumstances such as a color light turning green when it has successfully connected to a network. The use of this command and the effects themselves are entirely up to the implementer to use whenever a visual feedback is useful but it is not the same as and does not replace the identify mechanism used during commissioning.

The TriggerEffect command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	EffectIdentifier	enum8	desc			M
1	EffectVariant	enum8	desc			M

1.2.6.3.1. EffectIdentifier Field

This field specifies the identify effect to use. All values of the EffectIdentifier SHALL be supported. Implementors MAY deviate from the example light effects in the table below, but they SHOULD indicate during testing how they handle each effect.

This field SHALL contain one of the non-reserved values listed below.

Table 3. Values of the EffectIdentifier Field of the TriggerEffect Command

Value	Effect	Notes
0x00	Blink	e.g., Light is turned on/off once.

Value	Effect	Notes
0x01	Breathe	e.g., Light is turned on/off over 1 second and repeated 15 times.
0x02	Okay	e.g., Colored light turns green for 1 second; non-colored light flashes twice.
0x0b	Channel change	e.g., Colored light turns orange for 8 seconds; non-colored light switches to the maximum brightness for 0.5s and then minimum brightness for 7.5s.
0xfe	Finish effect	Complete the current effect sequence before terminating. e.g., if in the middle of a breathe effect (as above), first complete the current 1s breathe effect and then terminate the effect.
0xff	Stop effect	Terminate the effect as soon as possible.

1.2.6.3.2. EffectVariant Field

This field is used to indicate which variant of the effect, indicated in the EffectIdentifier field, SHOULD be triggered. If a device does not support the given variant, it SHALL use the default variant. This field SHALL contain one of the values listed below:

Table 4. Values of the EffectVariant Field of the TriggerEffect Command

Value	Description
0x00	Default

1.2.6.3.3. Effect on Receipt

On receipt of this command, the device SHALL execute the trigger effect indicated in the EffectIdentifier and EffectVariant fields. If the EffectVariant field specifies a variant that is not supported on the device, it SHALL execute the default variant.

1.2.6.4. IdentifyQueryResponse Command

This command is generated in response to receiving an IdentifyQuery command, see [IdentifyQuery Command](#), in the case that the device is currently identifying itself.

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Timeout	uint16	all			M

1.2.6.4.1. Timeout Field

This field contains the current value of the IdentifyTime attribute, and specifies the length of time, in seconds, that the device will continue to identify itself.

1.2.6.4.2. Effect on Receipt

On receipt of this command, the device is informed of a device in the network which is currently identifying itself. This information MAY be particularly beneficial in situations where there is no commissioning tool. Note that there MAY be multiple responses in case the IdentifyQuery command was sent as a groupcast or multicast, even from a single node in case multiple endpoints on that node are currently identifying themselves.

1.3. Groups

The Groups cluster manages, per endpoint, the content of the node-wide Group Table that is part of the underlying interaction layer.

In a network supporting fabrics, group IDs referenced by attributes or other elements of this cluster are scoped to the accessing fabric.

The Groups cluster is scoped to the endpoint. Groups cluster commands support discovering the endpoint membership in a group, adding the endpoint to a group, removing the endpoint from a group, removing endpoint membership from all groups. All commands defined in this cluster SHALL only affect groups scoped to the accessing fabric.

When group names are supported, the server stores a name string, which is set by the client for each assigned group and indicated in response to a client request.

Note that configuration of group addresses for outgoing commands is achieved using the Message Layer mechanisms where the Group Table is not involved. Hence this cluster does not play a part in that.

1.3.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	global mandatory ClusterRevision attribute added; CCB 1745 2100
2	CCB 2289
3	CCB 2310 2704
4	new data model format and notation

1.3.2. Classification

Hierarchy	Role	PICS Code
Base	Utility	G

1.3.3. Cluster Identifiers

Identifier	Name
0x0004	Groups

1.3.4. Features

This cluster SHALL support the FeatureMap global attribute:

Bit	Code	Name	Def	Description
0	GN	Group Names	0	The ability to store a name for a group.

The following sections describe each feature in some detail. Further details are found within the specification.

1.3.4.1. Group Names Feature

The Group Names feature indicates the ability to store a name for a group when a group is added.

1.3.5. Dependencies

For correct operation of the AddGroupIfIdentifying command, any endpoint that supports the Groups server cluster SHALL also support the Identify server cluster.

1.3.6. Attributes

The attribute IDs for the Groups cluster are listed in the table below.

Table 5. Attribute IDs for the Groups Cluster

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	NameSupport	map8	desc	F	0	R V	M

1.3.6.1. NameSupport Attribute

This attribute provides legacy, read-only access to whether the Group Names feature is supported. The most significant bit, bit 7, SHALL be equal to bit 0 of the FeatureMap attribute. All other bits SHALL be 0.

Bit	Code	Name	Def	Description
7	GN	Group Names	0	The ability to store a name for a group.

1.3.6.2. Group Names

Group names are between 0 and 16 bytes long. Support of group names is optional, and is indicated by the FeatureMap attribute.

1.3.7. Commands

The command IDs for the Groups cluster are listed in the table below.

Table 6. Command IDs for the Groups Cluster

ID	Name	Direction	Response	Access	Conformance
0x00	AddGroup	client ⇒ server	AddGroupResponse	F M	M
0x01	ViewGroup	client ⇒ server	ViewGroupResponse	F O	M
0x02	GetGroupMembership	client ⇒ server	GetGroupMembershipResponse	F O	M
0x03	RemoveGroup	client ⇒ server	RemoveGroupResponse	F M	M
0x04	RemoveAllGroups	client ⇒ server	Y	F M	M
0x05	AddGroupIfIdentifying	client ⇒ server	Y	F M	M
0x00	AddGroupResponse	server ⇒ client	N		M
0x01	ViewGroupResponse	server ⇒ client	N		M
0x02	GetGroupMembershipResponse	server ⇒ client	N		M
0x03	RemoveGroupResponse	server ⇒ client	N		M

1.3.7.1. AddGroup Command

The AddGroup command allows a client to add group membership in a particular group for the server endpoint.

The AddGroup command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	1 to max			M
1	GroupName	string	max 16			M

1.3.7.1.1. When Generated

The GroupID field SHALL be used to identify the group and any associated key material to which

the server endpoint is to be added. The `GroupName` field MAY be set to a human-readable name for the group. If the client has no name for the group, the `GroupName` field SHALL be set to the empty string.

1.3.7.1.2. Effect on Receipt

If the server does not support group names, the `GroupName` field SHALL be ignored.

On receipt of the `AddGroup` command, the server SHALL perform the following procedure:

1. If the command fields are not within constraints, the status SHALL be `CONSTRAINT_ERROR`, and the server continues from step 6.
2. If the receiving node requires security material to support the group ID and that material does not exist for this group ID, the status SHALL be `UNSUPPORTED_ACCESS` and the server continues from step 6.
3. If the server endpoint is a member of the group indicated by the `GroupID`, the group name SHALL be updated (if supported) to `GroupName`, the status SHALL be `SUCCESS`, and the server continues from step 6.
4. If there are no available resources to add the membership for the server endpoint, the status SHALL be `RESOURCE_EXHAUSTED`, and the server continues from step 6.
5. The server SHALL add the server endpoint as a member of the group indicated by the `GroupID`, the group name SHALL be updated (if supported) to `GroupName`, and the status SHALL be `SUCCESS`.
 - a. If the `GroupID` had already been added to the Group Table because of a previous `AddGroup` or `AddGroupIfIdentifying` command and a `GroupName` is provided and the server supports `GroupName` storage, then the `GroupName` associated with the `GroupID` in the Group Table SHALL be updated to reflect the new `GroupName` provided for the Group, such that subsequent `ViewGroup` commands yield the same name for all endpoints which have a group association to the given `GroupID`.
6. If the `AddGroup` command was received as a unicast, the server SHALL generate an `AddGroupResponse` command with the `Status` field set to the evaluated status. If the `AddGroup` command was received as a groupcast, the server SHALL NOT generate an `AddGroupResponse` command.

See [AddGroupResponse Command](#) for a description of the `AddGroupResponse` command.

1.3.7.2. `ViewGroup` Command

The `ViewGroup` command allows a client to request that the server responds with a `ViewGroupResponse` command containing the name string for a particular group.

The `ViewGroup` command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	1 to max			M

1.3.7.2.1. Effect on Receipt

On receipt of the ViewGroup command, the server SHALL perform the following procedure:

1. If the command fields are not within constraints, the status SHALL be CONSTRAINT_ERROR and the server continues from step 4.
2. If the server endpoint is a member of the group indicated by the GroupID, the status SHALL be SUCCESS, and the server continues from step 4.
3. Else the status SHALL be NOT_FOUND.
4. If the ViewGroup command was received as a unicast, the server SHALL generate a ViewGroupResponse command for the group, and the Status field set to the evaluated status. If the ViewGroup command was received as a groupcast, the server SHALL NOT generate a ViewGroupResponse command.

See [ViewGroupResponse Command](#) for a description of the ViewGroupResponse command.

1.3.7.3. GetGroupMembership Command

The GetGroupMembership command allows a client to inquire about the group membership of the server endpoint, in a number of ways.

The GetGroupMembership command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupList	list[group-id]	all[1 to max]			M

1.3.7.3.1. Effect on Receipt

On receipt of the GetGroupMembership command, the server SHALL respond with group membership information using the GetGroupMembershipResponse command as follows:

If the GroupList field is empty, the server SHALL respond with all group IDs indicating the groups of which the server endpoint is a member.

If the GroupList field contains at least one group ID indicating a group of which the server endpoint is a member, the server SHALL respond with each group ID indicating a group of which the server endpoint is a member that matches a group in the GroupList field.

If the GroupList field contains one or more group IDs but does not contain any group ID indicating a group of which the server endpoint is a member, the server SHALL only respond if the command is unicast. The response SHALL return with an empty GroupList field.

1.3.7.4. RemoveGroup Command

The RemoveGroup command allows a client to request that the server removes the membership for the server endpoint, if any, in a particular group.

The RemoveGroup command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	1 to max			M

1.3.7.4.1. Effect on Receipt

On receipt of the RemoveGroup command, the server SHALL perform the following procedure:

1. If the command fields are not within constraints, the status SHALL be CONSTRAINT_ERROR and the server continues from step 4.
2. If the server endpoint is a member of the group indicated by the GroupID, the server SHALL remove the server endpoint membership in the group, the status SHALL be SUCCESS, and the server continues from step 4.
3. Else the status SHALL be NOT_FOUND.
4. If the RemoveGroup command was received as a unicast, the server SHALL generate a RemoveGroupResponse command with the Status field set to the evaluated status. If the RemoveGroup command was received as a groupcast, the server SHALL NOT generate a RemoveGroupResponse command.

See [RemoveGroupResponse Command](#) for a description of the RemoveGroupResponse command.

Additionally, if the Scenes cluster is supported on the same endpoint, scenes associated with the indicated group SHALL be removed on that endpoint.

1.3.7.5. RemoveAllGroups Command

The RemoveAllGroups command allows a client to direct the server to remove all group associations for the server endpoint.

The RemoveAllGroups command has no data fields.

1.3.7.5.1. Effect on Receipt

On receipt of this command, the server SHALL remove all group memberships for the server endpoint from the Group Table. If the RemoveAllGroups command was received as unicast and a response is not suppressed, the server SHALL generate a response with the Status field set to SUCCESS.

Additionally, if the Scenes cluster is supported on the same endpoint, all scenes, except for scenes associated with group ID 0, SHALL be removed on that endpoint.

1.3.7.6. AddGroupIfIdentifying Command

The AddGroupIfIdentifying command allows a client to add group membership in a particular group for the server endpoint, on condition that the endpoint is identifying itself. Identifying functionality is controlled using the Identify cluster, (see [Identify](#)).

This command might be used to assist configuring group membership in the absence of a commissioning tool.

The AddGroupIfIdentifying command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	1 to max			M
1	GroupName	string	max 16			M

1.3.7.6.1. When Generated

The GroupID field SHALL be used to identify the group and any associated key material to which the server endpoint is to be added. The GroupName field MAY be set to a human-readable name for the group. If the client has no name for the group, the GroupName field SHALL be set to the empty string.

1.3.7.6.2. Effect on Receipt

If the server does not support group names, the GroupName field SHALL be ignored.

On receipt of the AddGroupIfIdentifying command, the server SHALL perform the following procedure:

1. The server verifies that it is currently identifying itself. If the server is not currently identifying itself, the status SHALL be SUCCESS, and the server continues from step 7.
2. If the command fields are not within constraints, the status SHALL be CONSTRAINT_ERROR and the server continues from step 7.
3. If the receiving node requires security material to support the group ID, and that material does not exist for this group ID, the status SHALL be UNSUPPORTED_ACCESS and the server continues from step 7.
4. If the server endpoint is a member of the group indicated by the GroupID, the status SHALL be SUCCESS and the server continues from step 7.
5. If there are no available resources to add the membership for the server endpoint, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 7.
6. The server SHALL add the server endpoint as a member of the group indicated by the GroupID, the group name SHALL be updated (if supported) to GroupName, and the status SHALL be SUCCESS.
 - a. If the GroupID had already been added to the Group Table because of a previous AddGroup or AddGroupIfIdentifying command and a GroupName is provided and the server supports GroupName storage, then the GroupName associated with the GroupID in the Group Table SHALL be updated to reflect the new GroupName provided for the Group, such that subsequent ViewGroup commands yield the same name for all endpoints which have a group association to the given GroupID.
7. If the AddGroupIfIdentifying command was received as unicast and the evaluated status is not SUCCESS, or if the AddGroupIfIdentifying command was received as unicast and the evaluated

status is SUCCESS and a response is not suppressed, the server SHALL generate a response with the Status field set to the evaluated status.

1.3.7.7. AddGroupResponse Command

The AddGroupResponse is sent by the Groups cluster server in response to an AddGroup command.

The AddGroupResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupID	group-id	1 to max			M

1.3.7.7.1. When Generated

This command is generated in response to a received AddGroup command. The Status field is set according to the Effect on Receipt section of the AddGroup command. The GroupID field is set to the GroupID field of the received AddGroup command.

1.3.7.8. ViewGroupResponse Command

The ViewGroupResponse command is sent by the Groups cluster server in response to a ViewGroup command.

The ViewGroupResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupID	group-id	1 to max			M
2	GroupName	string	max 16			M

1.3.7.8.1. When Generated

This command is generated in response to a received ViewGroup command. The Status field is set according to the Effect on Receipt section of the ViewGroup command. The GroupID field is set to the GroupID field of the received ViewGroup command. If the status is SUCCESS, and group names are supported, the GroupName field is set to the group name associated with that group in the Group Table; otherwise it is set to the empty string.

1.3.7.9. GetGroupMembershipResponse Command

The GetGroupMembershipResponse command is sent by the Groups cluster server in response to a GetGroupMembership command.

The GetGroupMembershipResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Capacity	uint8	all	X		M
1	GroupList	list[group-id]	all[1 to max]			M

The fields of the GetGroupMembershipResponse command have the following semantics:

The Capacity field SHALL contain the remaining capacity of the Group Table of the node. The following values apply:

- 0 - No further groups MAY be added.
- $0 < \text{Capacity} < 0xfe$ - Capacity holds the number of groups that MAY be added.
- $0xfe$ - At least 1 further group MAY be added (exact number is unknown).
- null - It is unknown if any further groups MAY be added.

The GroupList field SHALL contain either the group IDs of all the groups in the Group Table for which the server endpoint is a member of the group (in the case where the GroupList field of the received GetGroupMembership command was empty), or the group IDs of all the groups in the Group Table for which the server endpoint is a member of the group *and* for which the group ID was included in the the GroupList field of the received GetGroupMembership command (in the case where the GroupList field of the received GetGroupMembership command was not empty).

Zigbee: If the total number of groups will cause the maximum payload length of a frame to be exceeded, then the GroupList field SHALL contain only as many groups as will fit.

1.3.7.9.1. When Generated

See GetGroupMembership Command [Effect on Receipt](#).

1.3.7.10. RemoveGroupResponse Command

The RemoveGroupResponse command is generated by the server in response to the receipt of a RemoveGroup command.

The RemoveGroupResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupID	group-id	1 to max			M

1.3.7.10.1. When Generated

This command is generated in response to a received RemoveGroup command. The Status field is according to the Effect on Receipt section of the RemoveGroup command. The GroupID field is set to the GroupID field of the received RemoveGroup command.

1.4. Scenes

The Scenes cluster provides attributes and commands for setting up and recalling scenes. Each scene corresponds to a set of stored values of specified attributes for one or more clusters on the same end point as the Scenes cluster.

In most cases scenes are associated with a particular group identifier. Scenes MAY also exist without a group, in which case the value 0 replaces the group identifier. Note that extra care is required in these cases to avoid a scene identifier collision, and that commands related to scenes without a group MAY only be unicast, i.e., they MAY not be multicast or broadcast.

In a network supporting fabrics, scenes are scoped to the accessing fabric. When storing scene information, implementations need to take care of this.

NOTE Support for Scenes cluster is provisional.

1.4.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	global mandatory ClusterRevision attribute added; CCB 1745
2	TransitionTime field added to the RecallScene command
3	CCB 2427 3026
4	new data model format and notation

1.4.2. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	S	Type 1 (client to server)

1.4.3. Cluster Identifiers

Identifier	Name
0x0005	Scenes

1.4.4. Features

This cluster SHALL support the FeatureMap global attribute:

Bit	Code	Name	Def	Description
0	SN	Scene Names	0	The ability to store a name for a scene.

The following sections describe each feature in some detail. Further details are found within the specification.

1.4.4.1. Scene Names Feature

The Scene Names feature indicates the ability to store a name for a scene when a scene is added.

1.4.5. Dependencies

Any endpoint that implements the Scenes server cluster SHALL also implement the Groups server cluster.

Note that the [RemoveGroup command](#) and the [RemoveAllGroups command](#) of the [Groups cluster](#) also remove scenes.

1.4.6. Data Types

1.4.6.1. AttributeValuePair

This data type indicates a combination of an identifier and the value of an attribute.

ID	Name	Type	Constraint	Quality	Access	Default	Conformance
0	Attribut-eID	attribute-id	all		RW		Matter !Zigbee
1	Attribute-Value	<i>variable</i>			RW		M

1.4.6.1.1. AttributeID

This field SHALL be present or not present, for all instances in the Scenes cluster. If this field is not present, then the data type of AttributeValue SHALL be determined by the order and data type defined in the cluster specification. Otherwise the data type of AttributeValue SHALL be the data type of the attribute indicated by AttributeID.

1.4.6.1.2. AttributeValue

This is the attribute value as part of an extension field set. See AttributeID to determine the data type for this field.

1.4.6.2. ExtensionFieldSet

This data type indicates for a given cluster a set of attributes and their values. Only attributes which have the "S" designation in the Quality column of the cluster specification SHALL be used in the AttributeValueList field.

ID	Name	Type	Constraint	Quality	Access	Default	Conformance
0	ClusterID	cluster-id	all		RW		M
1	Attribute-ValueList	list[AttributeValuePair]			RW		M

1.4.7. Attributes

The attribute IDs for the Scene cluster are listed in the table below.

Table 7. Scene Management Information Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	SceneCount	uint8	all	0	R V	M	
0x0001	CurrentScene	uint8	all	0	R V	M	
0x0002	CurrentGroup	group-id	all	0	R V	M	
0x0003	SceneValid	bool	all	FALSE	R V	M	
0x0004	NameSupport	map8	desc	0	R V	M	
0x0005	LastConfiguredBy	node-id	-	X	null	R V	O

1.4.7.1. SceneCount Attribute

The SceneCount attribute specifies the number of scenes currently in the server's Scene Table.

1.4.7.2. CurrentScene Attribute

The CurrentScene attribute holds the scene identifier of the scene last invoked.

1.4.7.3. CurrentGroup Attribute

The CurrentGroup attribute holds the group identifier of the scene last invoked, or 0 if the scene last invoked is not associated with a group.

1.4.7.4. SceneValid Attribute

The *SceneValid* attribute indicates whether the state of the server corresponds to that associated with the CurrentScene and CurrentGroup attributes. TRUE indicates that these attributes are valid, FALSE indicates that they are not valid.

Before a scene has been stored or recalled, this attribute is set to FALSE. After a successful StoreScene or RecallScene command it is set to TRUE. If, after a scene is stored or recalled, the state of the server is modified, this attribute is set to FALSE.

1.4.7.5. NameSupport Attribute

This attribute provides legacy, read-only access to whether the Scene Names feature is supported. The most significant bit, bit 7, SHALL be equal to bit 0 of the FeatureMap attribute. All other bits SHALL be 0.

Bit	Code	Name	Def	Description
7	SN	Scene Names	0	The ability to store a name for a scene.

1.4.7.5.1. Scene Names

Scene names are between 0 and 16 bytes long. Support of scene names is optional, and is indicated by the FeatureMap attribute.

1.4.7.6. LastConfiguredBy Attribute

The LastConfiguredBy attribute holds the Node ID (the IEEE address in case of Zigbee) of the node that last configured the Scene Table.

The null value indicates that the server has not been configured, or that the identifier of the node that last configured the Scenes cluster is not known.

1.4.8. Scene Table

The Scene Table is used to store information for each scene capable of being invoked on the server. Each scene is defined for a particular group.

The fields of each Scene Table entry consist of a number of sets. The base set consists of the first four fields of [Fields of a Scene Table Entry](#). A set of extension fields can be added by each additional cluster implemented on the same endpoint.

Table 8. Fields of a Scene Table Entry

Name	Type	Constraint	Description
SceneGroupID	group-id	all	The group identifier for which this scene applies, or 0 if the scene is not associated with a group.
SceneID	uint8	all	The identifier, unique within this group, which is used to identify this scene.
SceneName	string	0 to 16 bytes	The name of the scene (optional)

Name	Type	Constraint	Description
SceneTransitionTime	uint16	all	The amount of time, in seconds, it will take for a cluster to change from its current state to the requested state.
ExtensionFieldSets	Variable	Variable	See the Scene Table Extensions subsections of individual clusters. A Scene Table Extension SHALL only use attributes marked with "S" in the Quality column of the cluster definition. Each extension field set holds a set of values of these attributes for a cluster implemented on the same endpoint. The sum of all such sets defines a scene.
TransitionTime100ms	uint8	0 to 9	Together with the SceneTransitionTime field, this field allows the transition time to be specified in tenths of a second.

1.4.8.1. Scene Names

Scene names are between 0 and 16 bytes long. Support of scene names is optional, and is indicated by the NameSupport attribute. If scene names are not supported, any commands that write a scene name SHALL simply discard the name, and any command that returns a scene names SHALL return an empty string.

Zigbee: Note older implementations may return the null string.

1.4.8.2. Maximum Number of Scenes

The number of scenes capable of being stored in the Scene Table is defined by the profile in which this cluster is used. The default maximum, in the absence of specification by the profile, is 16.

1.4.9. Commands

The command IDs for the Scenes cluster are listed in the table below.

Table 9. Command IDs for the Scenes Cluster

ID	Name	Direction	Response	Access	Conformance
0x00	AddScene	client ⇒ server	AddSceneResponse	M	M
0x01	ViewScene	client ⇒ server	ViewSceneResponse	O	M
0x02	RemoveScene	client ⇒ server	RemoveSceneResponse	M	M
0x03	RemoveAllScenes	client ⇒ server	RemoveAllScenesResponse	M	M
0x04	StoreScene	client ⇒ server	StoreSceneResponse	M	M
0x05	RecallScene	client ⇒ server	Y	O	M
0x06	GetSceneMembership	client ⇒ server	GetSceneMembershipResponse	O	M
0x40	EnhancedAddScene	client ⇒ server	EnhancedAddSceneResponse	M	O
0x41	Enhanced-ViewScene	client ⇒ server	EnhancedViewSceneResponse	O	O
0x42	CopyScene	client ⇒ server	CopySceneResponse	M	O
0x00	AddSceneResponse	server ⇒ client	N		M
0x01	ViewSceneResponse	server ⇒ client	N		M
0x02	RemoveSceneResponse	server ⇒ client	N		M
0x03	RemoveAllScenes-Response	server ⇒ client	N		M
0x04	StoreSceneResponse	server ⇒ client	N		M
0x06	GetSceneMembershipResponse	server ⇒ client	N		M
0x40	EnhancedAddSceneResponse	server ⇒ client	N		O
0x41	Enhanced-ViewSceneResponse	server ⇒ client	N		O
0x42	CopySceneResponse	server ⇒ client	N		O

1.4.9.1. Generic Usage Notes

Scene identifier 0, along with group identifier 0, is reserved for the global scene used by the On/Off cluster.

On receipt of the AddScene command, the SceneTransitionTime field of the Scene Table SHALL be

updated with the value of the TransitionTime field and the TransitionTime100ms field SHALL be set to zero.

1.4.9.2. AddScene Command

The AddScene command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	all			M
1	SceneID	uint8	all			M
2	TransitionTime	uint16	all			M
3	SceneName	string	max 16			M
4	ExtensionFieldSets	list[ExtensionFieldSet]				M

It is not mandatory for an extension field set to be included in the command for every cluster on that endpoint that has a defined extension field set. Extension field sets MAY be omitted, including the case of no extension field sets at all.

1.4.9.2.1. Effect on Receipt

On receipt of the AddScene command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 4.
2. The server verifies that it has free entries in its Scene Table. If the server has no further free entries in its Scene Table, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 4.
3. The server adds the scene entry into its Scene Table with fields copied from the AddScene command data fields and the status SHALL be SUCCESS. If there is already a scene in the Scene Table with the same scene identifier and group identifier, it SHALL overwrite it.
4. If the AddScene command was received as a unicast, the server SHALL then generate an AddSceneResponse command with the Status field set to the evaluated status. If the AddScene command was received as a groupcast, the server SHALL NOT generate an AddSceneResponse command.

See [AddSceneResponse Command](#) for a description of the AddSceneResponse command.

1.4.9.3. ViewScene Command

The ViewScene command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	all			M
1	SceneID	uint8	all			M

1.4.9.3.1. Effect on Receipt

On receipt of the ViewScene command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 4.
2. The server verifies that the scene entry corresponding to the GroupID and SceneID fields exists in its Scene Table. If there is no such entry in its Scene Table, the status SHALL be NOT_FOUND and the server continues from step 4.
3. The server retrieves the requested scene entry from its Scene Table and the status SHALL be SUCCESS.
4. If the ViewScene command was received as a unicast, the server SHALL then generate a ViewSceneResponse command with the retrieved scene entry and the Status field set to the evaluated status. If the ViewScene command was received as a groupcast, the server SHALL NOT generate a ViewSceneResponse command.

See [ViewSceneResponse Command](#) for a description of the ViewSceneResponse command.

1.4.9.4. RemoveScene Command

The RemoveScene command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	all			M
1	SceneID	uint8	all			M

1.4.9.4.1. Effect on Receipt

On receipt of the RemoveScene command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 4.
2. The server verifies that the scene entry corresponding to the GroupID and SceneID fields exists in its Scene Table. If there is no such entry in its Scene Table, the status SHALL be NOT_FOUND and the server continues from step 4.
3. The server removes the requested scene entry from its Scene Table and the status SHALL be SUCCESS.

4. If the RemoveScene command was received as a unicast, the server SHALL then generate a RemoveSceneResponse command with the Status field set to the evaluated status. If the RemoveScene command was received as a groupcast, the server SHALL NOT generate a RemoveSceneResponse command.

See [RemoveSceneResponse Command](#) for a description of the RemoveSceneResponse command.

1.4.9.5. RemoveAllScenes Command

The RemoveAllScenes command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	all			M

1.4.9.5.1. Effect on Receipt

On receipt of the RemoveAllScenes command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 3.
2. The server SHALL remove all scenes, corresponding to the value of the GroupID field, from its Scene Table and the status SHALL be SUCCESS.
3. If the RemoveAllScenes command was received as a unicast, the server SHALL then generate a RemoveAllScenesResponse command with the Status field set to the evaluated status. If the RemoveAllScenes command was received as a groupcast, the server SHALL NOT generate a RemoveAllScenesResponse command.

See [RemoveAllScenesResponse Command](#) for a description of the RemoveAllScenesResponse command.

1.4.9.6. StoreScene Command

The StoreScene command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	all			M
1	SceneID	uint8	all			M

1.4.9.6.1. Effect on Receipt

On receipt of the StoreScene command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 4.

2. The server verifies that it has free entries in its Scene Table. If the server has no further free entries in its Scene Table, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 4.
3. The server adds the scene entry into its Scene Table along with all extension field sets corresponding to the current state of other clusters on the same endpoint and with the SceneTransitionTime and SceneName fields set to 0 and the empty string, respectively. If there is already a scene in the Scene Table with the same SceneID and GroupID, it SHALL overwrite it, i.e., it SHALL first remove all information included in the original scene entry except for the SceneTransitionTime and SceneName fields, which are left unaltered. The status SHALL be SUCCESS.
4. If the StoreScene command was received as a unicast, the server SHALL then generate a StoreSceneResponse command with the Status field set to the evaluated status. If the StoreScene command was received as a groupcast, the server SHALL NOT generate a StoreSceneResponse command.

Note that if a scene to be stored requires a TransitionTime field and/or a SceneName field, these must be set up by a prior AddScene command, e.g., with no scene extension field sets.

See [StoreSceneResponse Command](#) for a description of the StoreSceneResponse command.

1.4.9.7. RecallScene Command

The RecallScene command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	all			M
1	SceneID	uint8	all			M
2	TransitionTime	uint16	all	X		O

1.4.9.7.1. Effect on Receipt

On receipt of the RecallScene command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 4.
2. The server verifies that the scene entry corresponding to the GroupID and SceneID fields exists in its Scene Table. If there is no such entry in its Scene Table, the status SHALL be NOT_FOUND and the server continues from step 4.
3. The server retrieves the requested scene entry from its Scene Table. For each other cluster implemented on the endpoint, it SHALL retrieve any corresponding extension fields from the Scene Table and set the attributes and corresponding state of the cluster accordingly. If there is no extension field set for a cluster, the state of that cluster SHALL remain unchanged. If an extension field set omits the values of any trailing attributes, the values of these attributes SHALL remain unchanged.
4. The server SHALL then generate a response with the Status field set to the evaluated status.

If the TransitionTime data field is present in the command and its value is not equal to null, this field SHALL indicate the transition time in 1/10ths of a second. In all other cases (command data field not present or value equal to null), the SceneTransitionTime field of the Scene Table entry SHALL indicate the transition time. The transition time determines how long the transition takes from the old cluster state to the new cluster state. It is recommended that, where possible (e.g., it is not possible for attributes with Boolean data type), a gradual transition SHOULD take place from the old to the new state over this time. However, the exact transition is manufacturer dependent.

1.4.9.8. GetSceneMembership Command

The GetSceneMembership command can be used to find an unused scene identifier within a certain group when no commissioning tool is in the network, or for a commissioning tool to get the used scene identifiers within a certain group, for the endpoint that implements this cluster.

The GetSceneMembership command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	GroupID	group-id	all			M

1.4.9.8.1. Effect on Receipt

On receipt of the GetSceneMembership command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 2.
2. If the GetSceneMembership command was received as a unicast, the server SHALL then generate a GetSceneMembershipResponse command with the Status field set to the evaluated status. If the GetSceneMembership command was not received as a unicast, the server SHALL only generate a GetSceneMembershipResponse command with the Status field set to the evaluated status if an entry within the Scene Table corresponds to the GroupID.

See [GetSceneMembershipResponse Command](#) for a description of the GetSceneMembershipResponse command.

1.4.9.9. EnhancedAddScene Command

The EnhancedAddScene command allows a scene to be added using a finer scene transition time than the AddScene command.

This command SHALL have the same data fields as the AddScene command, with the following difference:

The TransitionTime data field SHALL be measured in tenths of a second rather than in seconds.

1.4.9.9.1. Effect on Receipt

On receipt of the EnhancedAddScene command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 4.
2. The server verifies that it has free entries in its Scene Table. If the server has no further free entries in its Scene Table, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 4.
3. The server adds the scene entry into its Scene Table with fields copied from the EnhancedAddScene command data fields and the status SHALL be SUCCESS. If there is already a scene in the Scene Table with the same SceneID and GroupID, it SHALL overwrite it, i.e., it SHALL first remove all information included in the original scene entry. The TransitionTime field (measured in tenths of a second) SHALL be separated into whole seconds for the Scene-TransitionTime field and tenths of a second for the TransitionTime100ms field of the Scene Table entry, as specified.
4. If the EnhancedAddScene command was received as a unicast, the server SHALL then generate an EnhancedAddSceneResponse command with the Status field set to the evaluated status. If the EnhancedAddScene command was received as a groupcast, the server SHALL NOT generate an EnhancedAddSceneResponse command.

See [EnhancedAddSceneResponse Command](#) for a description of the EnhancedAddSceneResponse command.

1.4.9.10. EnhancedViewScene Command

The EnhancedViewScene command allows a scene to be retrieved using a finer scene transition time than the ViewScene command.

This command SHALL have the same data fields as the ViewScene command.

1.4.9.10.1. Effect on Receipt

On receipt of the EnhancedViewScene command, the server SHALL perform the following procedure:

1. If the value of the GroupID field is non-zero, the server verifies that the endpoint has an entry for that GroupID in the Group Table. If there is no such entry in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 4.
2. The server verifies that the scene entry corresponding to the GroupID and SceneID fields exists in its Scene Table. If there is no such entry in its Scene Table, the status SHALL be NOT_FOUND and the server continues from step 4.
3. The server retrieves the requested scene entry from its Scene Table and the status SHALL be SUCCESS.
4. If the EnhancedViewScene command was received as a unicast, the server SHALL then generate an EnhancedViewSceneResponse command with the Status field set to the evaluated status. If

the EnhancedViewScene command was received as a groupcast, the server SHALL NOT generate an EnhancedViewSceneResponse command.

See [EnhancedViewSceneResponse Command](#) for a description of the EnhancedViewSceneResponse command.

1.4.9.11. CopyScene Command

The CopyScene command allows a client to efficiently copy scenes from one group/scene identifier pair to another group/scene identifier pair.

The CopyScene command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Mode	map8	desc			M
1	GroupIdentifierFrom	group-id	all			M
2	SceneIdentifierFrom	uint8	all			M
3	GroupIdentifierTo	group-id	all			M
4	SceneIdentifierTo	uint8	all			M

1.4.9.11.1. Mode Field

The Mode field contains information of how the scene copy is to proceed. This field SHALL be formatted as illustrated in [Format of the Mode Field of the CopyScene Command](#).

Table 10. Format of the Mode Field of the CopyScene Command

Bit	Description
0	CopyAllScenes
1-7	(Reserved)

The CopyAllScenes subfield is 1-bit in length and indicates whether all scenes are to be copied. If this value is set to 1, all scenes are to be copied and the SceneIdentifierFrom and SceneIdentifierTo fields SHALL be ignored. Otherwise this field is set to 0.

1.4.9.11.2. GroupIdentifierFrom Field

The GroupIdentifierFrom field specifies the identifier of the group from which the scene is to be copied. Together with the SceneIdentifierFrom field, this field uniquely identifies the scene to copy from the Scene Table.

1.4.9.11.3. SceneIdentifierFrom Field

The SceneIdentifierFrom field specifies the identifier of the scene from which the scene is to be copied. Together with the GroupIdentifierFrom field, this field uniquely identifies the scene to copy from the Scene Table.

1.4.9.11.4. GroupIdentifierTo Field

The GroupIdentifierTo field specifies the identifier of the group to which the scene is to be copied. Together with the SceneIdentifierTo field, this field uniquely identifies the scene to copy to the Scene Table.

1.4.9.11.5. SceneIdentifierTo Field

The SceneIdentifierTo field specifies the identifier of the scene to which the scene is to be copied. Together with the GroupIdentifierTo field, this field uniquely identifies the scene to copy to the Scene Table.

1.4.9.11.6. Effect on Receipt

On receipt of the CopyScene command, the server SHALL perform the following procedure:

1. If the value of either the GroupIdentifierFrom field or the Group Identifier To field is non-zero, the server verifies that the endpoint has an entry for these non-zero group identifiers in the Group Table. If there are no such entries in the Group Table, the status SHALL be ILLEGAL_COMMAND and the server continues from step 5.
2. The server verifies that the scene entry corresponding to the Group Identifier From and SceneIdentifierFrom fields exists in its Scene Table. If there is no such entry in its Scene Table, the status SHALL be NOT_FOUND and the server continues from step 5.
3. If the CopyAllScenes sub-field of the Mode field is set to 1 or the scene entry corresponding to the GroupIdentifierTo and SceneIdentifierTo fields does not exist in the Scene Table and if the server has no further free entries in its Scene Table, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 5.
4. The status SHALL be SUCCESS. If the CopyAllScenes sub-field of the Mode field is set to 1, the server SHALL copy all its available scenes with group identifier equal to the GroupIdentifierFrom field under the group identifier specified in the GroupIdentifierTo field, leaving the scene identifiers the same. In this case, the SceneIdentifierFrom and SceneIdentifierTo fields are ignored. If the CopyAllScenes sub-field of the Mode field is set to 0, the server SHALL copy the Scene Table entry corresponding to the GroupIdentifierFrom and SceneIdentifierFrom fields to the Scene Table entry corresponding to the GroupIdentifierTo and SceneIdentifierTo fields. If a scene already exists under the same group/scene identifier pair, it SHALL be overwritten.
5. If the CopyScene command was received as a unicast, the server SHALL then generate a CopySceneResponse command with the Status field set to the evaluated status. If the CopyScene command was received as a groupcast, the server SHALL NOT generate an CopySceneResponse command.

See [CopySceneResponse Command](#) for a description of the CopySceneResponse command.

1.4.9.12. AddSceneResponse Command

The AddSceneResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupID	group-id	all			M
2	SceneID	uint8	all			M

1.4.9.12.1. When Generated

This command is generated in response to a received AddScene command, see [AddScene Command](#). The Status field is set according to the Effect on Receipt section for AddScene. The GroupID and SceneID fields are set to the corresponding fields of the received AddScene command.

1.4.9.13. ViewSceneResponse Command

The ViewSceneResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupID	group-id	all			M
2	SceneID	uint8	all			M
3	TransitionTime	uint16	all			desc
4	SceneName	string	max 16			desc
5	ExtensionFieldSets	list[ExtensionFieldSet]				desc

1.4.9.13.1. When Generated

This command is generated in response to a received ViewScene command, see [ViewScene Command](#).

The entry in the Scene Table with SceneID and GroupID given in the received ViewScene command is located (if possible). The Status field is set according to the Effect on Receipt section for ViewScene. The GroupID and SceneID fields are set to the corresponding fields in the received ViewScene command.

If the status is SUCCESS, the TransitionTime, SceneName and ExtensionFieldSets fields are copied from the corresponding fields in the Scene Table entry, otherwise they are omitted.

1.4.9.14. RemoveSceneResponse Command

The RemoveSceneResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupID	group-id	all			M
2	SceneID	uint8	all			M

1.4.9.14.1. When Generated

This command is generated in response to a received RemoveScene command, see [RemoveScene Command](#). The Status field is set according to the Effect on Receipt section for RemoveScene. The GroupID and SceneID fields are set to the corresponding fields of the received RemoveScene command.

1.4.9.15. RemoveAllScenesResponse Command

The RemoveAllScenesResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupID	group-id	all			M

1.4.9.15.1. When Generated

This command is generated in response to a received RemoveAllScenes command, see [RemoveAllScenes Command](#). The Status field is according to the Effect on Receipt section for RemoveAllScenes. The GroupID field is set to the corresponding field of the received RemoveAllScenes command.

1.4.9.16. StoreSceneResponse Command

The StoreSceneResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupID	group-id	all			M
2	SceneID	uint8	all			M

1.4.9.16.1. When Generated

This command is generated in response to a received StoreScene command, see [StoreScene Command](#). The Status field is set to SUCCESS, RESOURCE_EXHAUSTED or ILLEGAL_COMMAND (the endpoint is not a member of the group) as appropriate. The GroupID and SceneID fields are set to the corresponding fields of the received StoreScene command.

1.4.9.17. GetSceneMembershipResponse Command

The GetSceneMembershipResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	Capacity	uint8	all	X		M
2	GroupID	group-id	all			M
3	SceneList	list[uint8]				O

The fields of the get scene membership response command have the following semantics:

The Capacity field SHALL contain the remaining capacity of the Scene Table of the server (for all groups). The following values apply:

- 0 - No further scenes MAY be added.
- $0 < \text{Capacity} < 0xfe$ - Capacity holds the number of scenes that MAY be added.
- $0xfe$ - At least 1 further scene MAY be added (exact number is unknown).
- null - It is unknown if any further scenes MAY be added.

The Status field SHALL contain SUCCESS or ILLEGAL_COMMAND (the endpoint is not a member of the group) as appropriate.

The GroupID field SHALL be set to the corresponding field of the received GetSceneMembership command.

If the status is not SUCCESS then the SceneList field SHALL be omitted, else the SceneList field SHALL contain the identifiers of all the scenes in the Scene Table with the corresponding Group ID.

Zigbee: If the total number of scenes associated with this Group ID will cause the maximum payload length of a frame to be exceeded, then the SceneList field SHALL contain only as many scenes as will fit.

1.4.9.17.1. When Generated

This command is generated in response to a received GetSceneMembership command, see [GetSceneMembership Command](#).

1.4.9.18. EnhancedAddSceneResponse Command

The EnhancedAddSceneResponse command allows a server to respond to an EnhancedAddScene command, see [EnhancedAddScene Command](#).

This command SHALL have the same data fields as the AddSceneResponse command.

1.4.9.19. EnhancedViewSceneResponse Command

The EnhancedViewSceneResponse command allows a server to respond to an EnhancedViewScene command using a finer scene transition time.

This command SHALL have the same data fields as the ViewSceneResponse command, with the following difference:

The TransitionTime field SHALL be measured in tenths of a second rather than in seconds.

1.4.9.19.1. When Generated

The EnhancedViewSceneResponse command is generated in response to a received EnhancedViewScene command. The entry in the Scene Table with scene identifier and group identifier given in the received EnhancedViewScene command is located (if possible). The Status field is set to SUCCESS, CONSTRAINT_ERROR (the group identifier is not in range), NOT_FOUND (the scene is not present in the Scene Table) or ILLEGAL_COMMAND (the endpoint is not a member of the group) as appropriate. The GroupID and SceneID fields are set to the corresponding fields in the received EnhancedViewScene command.

If the status is SUCCESS, the TransitionTime, SceneName and ExtensionFieldSets fields are copied from the corresponding fields in the Scene Table entry, otherwise they are omitted.

The TransitionTime field (measured in tenths of a second) SHALL be calculated from the SceneTransitionTime field (measured in seconds) and the TransitionTime100ms field of the Scene Table entry, as specified.

1.4.9.20. CopySceneResponse Command

The CopySceneResponse command allows a server to respond to a CopyScene command.

The CopySceneResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	enum8	desc			M
1	GroupIdentifierFrom	group-id	all			M
2	SceneIdentifierFrom	uint8	all			M

1.4.9.20.1. Status field

The Status field contains the status of the copy scene attempt. This field SHALL be set to one of the non-reserved values listed in [Values of the Status Field of the CopySceneResponse Command](#).

Table 11. Values of the Status Field of the CopySceneResponse Command

Status Field Value	Description
SUCCESS	Success
ILLEGAL_COMMAND	Invalid scene specified

Status Field Value	Description
RESOURCE_EXHAUSTED	Insufficient space in the Scene Table

1.4.9.20.2. GroupIdentifierFrom Field

The GroupIdentifierFrom field specifies the identifier of the group from which the scene was copied, as specified in the CopyScene command. Together with the SceneIdentifierFrom field, this field uniquely identifies the scene that was copied from the Scene Table.

1.4.9.20.3. SceneIdentifierFrom Field

The SceneIdentifierFrom field specifies the identifier of the scene from which the scene was copied, as specified in the CopyScene command. Together with the GroupIdentifierFrom field, this field uniquely identifies the scene that was copied from the Scene Table.

1.4.9.20.4. When Generated

The CopySceneResponse command is generated in response to a received CopyScene command, see [CopyScene Command](#). If, during the copy, there is no more space in the Scene Table for the entire next scene to be copied, the Status field SHALL be set to RESOURCE_EXHAUSTED and the scenes already copied SHALL be kept. If either the GroupIdentifierFrom field or the GroupIdentifierTo field are not in the correct range, the Status field SHALL be set to CONSTRAINT_ERROR. If the GroupIdentifierFrom and SceneIdentifierFrom fields do not specify a scene that exists in the Scene Table, the Status field SHALL be set to ILLEGAL_COMMAND. Otherwise, if the copy was successful, the Status field SHALL be set to SUCCESS. The GroupIdentifierFrom and SceneIdentifierFrom fields SHALL be set to the same values as in the corresponding fields of the received CopyScene command.

1.5. On/Off

Attributes and commands for turning devices on and off.

1.5.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	global mandatory ClusterRevision attribute added; CCB 1555
2	ZLO 1.0: StartUpOnOff
3	FeatureMap global attribute support with Level Control and Lighting feature
4	new data model format and notation

1.5.2. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	OO	Type 1 (client to server)

1.5.3. Cluster Identifiers

Identifier	PICS Code	Name
0x0006	OO	On/Off

1.5.4. Features

This cluster SHALL support the FeatureMap global attribute.

Bit	Code	Feature	Description
0	LT	Level Control for Lighting	Behavior that supports lighting applications.

The following sections describe each feature in some detail. Further details are found within the specification.

1.5.4.1. Level Control for Lighting Feature

This cluster is used for a lighting application.

On receipt of a Level Control cluster command that causes the OnOff attribute to be set to FALSE, the OnTime attribute SHALL be set to 0.

On receipt of a Level Control cluster command that causes the OnOff attribute to be set to TRUE, if the value of the OnTime attribute is equal to 0, the server SHALL set the OffWaitTime attribute to 0.

1.5.5. Data Types

1.5.5.1. StartUpOnOffEnum

The data type StartUpOnOffEnum is derived from enum8. The values of the StartUpOnOffEnum data type are listed below.

Value	Name	Conformance	Description
0	Off	M	Set the OnOff attribute to FALSE
1	On	M	Set the OnOff attribute to TRUE

Value	Name	Conformance	Description
2	Toggle	M	If the previous value of the OnOff attribute is equal to FALSE, set the OnOff attribute to TRUE. If the previous value of the OnOff attribute is equal to TRUE, set the OnOff attribute to FALSE (toggle).

1.5.6. Attributes

The server supports the attributes shown in [Attributes of the On/Off Server Cluster](#).

Table 12. Attributes of the On/Off Server Cluster

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	OnOff	bool	all	SN	FALSE	R V	M
0x4000	GlobalSceneControl	bool	all		TRUE	R V	LT
0x4001	OnTime	uint16	all	X	0	RW VO	LT
0x4002	OffWaitTime	uint16	all	X	0	RW VO	LT
0x4003	StartUpOnOff	Star-tUpOnOffEnum	desc	XN	MS	RW VM	LT

If the Scenes server cluster is implemented on the same endpoint, the following extension field SHALL be added to the Scene Table:

- OnOff

1.5.6.1. OnOff Attribute

The OnOff attribute indicates whether the device type implemented on the endpoint is turned off or turned on, in these cases the value of the OnOff attribute equals FALSE, or TRUE respectively.

1.5.6.2. GlobalSceneControl Attribute

In order to support the use case where the user gets back the last setting of a set of devices (e.g. level settings for lights), a global scene is introduced which is stored when the devices are turned off and recalled when the devices are turned on. The global scene is defined as the scene that is stored with group identifier 0 and scene identifier 0.

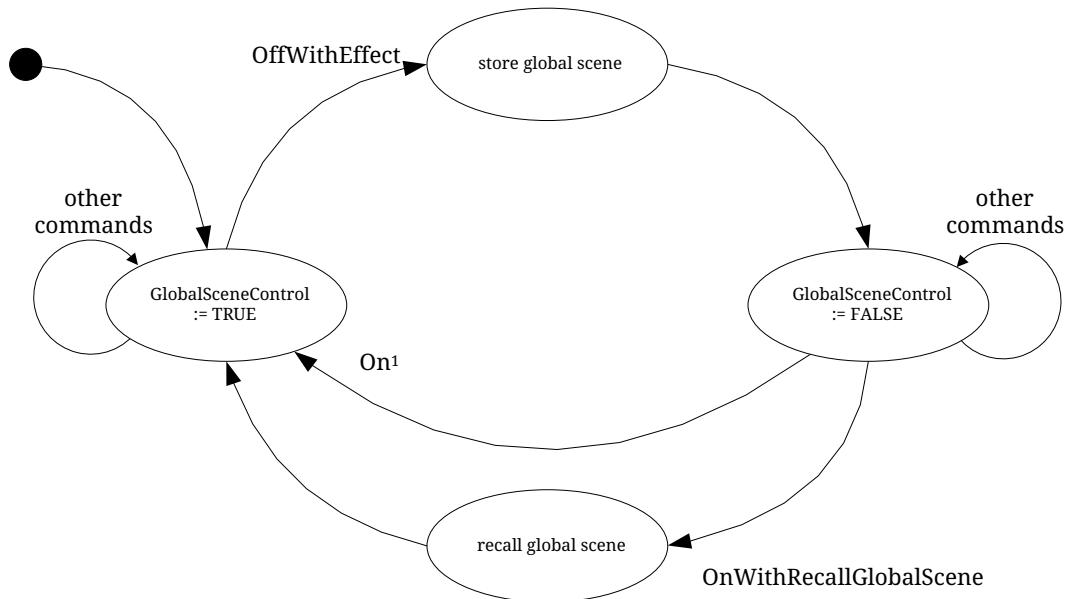
The GlobalSceneControl attribute is defined in order to prevent a second Off command storing the all-devices-off situation as a global scene, and to prevent a second On command destroying the cur-

rent settings by going back to the global scene.

The GlobalSceneControl attribute SHALL be set to TRUE after the reception of a command which causes the OnOff attribute to be set to TRUE, such as a standard On command, a MoveToLevel(WithOnOff) command, a RecallScene command or a OnWithRecallGlobalScene command (see [OnWithRecallGlobalScene Command](#)).

The GlobalSceneControl attribute is set to FALSE after reception of a OffWithEffect command.

These concepts are illustrated in [Explanation of the Behavior of Store and Recall Global Scene functionality using a State Diagram](#).



Note 1: Any command which causes the OnOff attribute to be set to TRUE except OnWithRecallGlobalScene, e.g. On or Toggle.

Figure 1. Explanation of the Behavior of Store and Recall Global Scene functionality using a State Diagram

1.5.6.3. OnTime Attribute

The OnTime attribute specifies the length of time (in 1/10ths second) that the ‘On’ state SHALL be maintained before automatically transitioning to the ‘Off’ state when using the OnWithTimedOff command. This attribute can be written at any time, but writing a value only has effect when in the ‘Timed On’ state. See [OnWithTimedOff Command](#) for more details.

1.5.6.4. OffWaitTime Attribute

The OffWaitTime attribute specifies the length of time (in 1/10ths second) that the ‘Off’ state SHALL be guarded to prevent another OnWithTimedOff command turning the server back to its ‘On’ state (e.g., when leaving a room, the lights are turned off but an occupancy sensor detects the leaving person and attempts to turn the lights back on). This attribute can be written at any time, but writing a value only has an effect when in the ‘Timed On’ state followed by a transition to the ‘Delayed Off’ state, or in the ‘Delayed Off’ state. See [OnWithTimedOff Command](#) for more details.

1.5.6.5. StartUpOnOff Attribute

The StartUpOnOff attribute SHALL define the desired startup behavior of a device when it is supplied with power and this state SHALL be reflected in the OnOff attribute. If the value is null, the OnOff attribute is set to its previous value. Otherwise, the behavior is defined in the table defining [StartUpOnOffEnum](#).

This behavior does not apply to reboots associated with OTA. After an OTA restart, the OnOff attribute shall return to its value prior to the restart.

1.5.7. Commands

The command IDs for the On/Off cluster are listed below.

Table 13. Command IDs for the On/Off Cluster

ID	Name	Direction	Response	Access	Conformance
0x00	Off	client ⇒ server	Y	O	M
0x01	On	client ⇒ server	Y	O	M
0x02	Toggle	client ⇒ server	Y	O	M
0x40	OffWithEffect	client ⇒ server	Y	O	LT
0x41	OnWithRecallGlobalScene	client ⇒ server	Y	O	LT
0x42	OnWithTimedOff	client ⇒ server	Y	O	LT

1.5.7.1. Off Command

This command does not have any data fields.

1.5.7.1.1. Effect on Receipt

On receipt of the Off command, a server SHALL set the OnOff attribute to FALSE.

Additionally, when the OnTime attribute is supported, the server SHALL set the OnTime attribute to 0.

1.5.7.2. On Command

This command does not have any data fields.

1.5.7.2.1. Effect on Receipt

On receipt of the On command, a server SHALL set the OnOff attribute to TRUE.

Additionally, when the OnTime and OffWaitTime attributes are both supported, if the value of the OnTime attribute is equal to 0, the server SHALL set the OffWaitTime attribute to 0.

1.5.7.3. Toggle Command

This command does not have any data fields.

1.5.7.3.1. Effect on Receipt

On receipt of the Toggle command, if the value of the OnOff attribute is equal to FALSE, the server SHALL set the OnOff attribute to TRUE, otherwise, the server SHALL set the OnOff attribute to FALSE.

Additionally, when the OnTime and OffWaitTime attributes are both supported, if the value of the OnOff attribute is equal to FALSE and if the value of the OnTime attribute is equal to 0, the server SHALL set the OffWaitTime attribute to 0. If the value of the OnOff attribute is equal to TRUE, the server SHALL set the OnTime attribute to 0.

1.5.7.4. OffWithEffect Command

The OffWithEffect command allows devices to be turned off using enhanced ways of fading.

The OffWithEffect command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	EffectIdentifier	uint8	desc			M
1	EffectVariant	uint8	desc			M

1.5.7.4.1. EffectIdentifier Field

The EffectIdentifier field specifies the fading effect to use when turning the device off. This field SHALL contain one of the non-reserved values listed in [Values of the EffectIdentifier Field of the OffWithEffect Command](#).

Table 14. Values of the EffectIdentifier Field of the OffWithEffect Command

Effect Identifier Field Value	Description
0x00	Delayed All Off
0x01	Dying Light
0x02 to 0xfe	Reserved

1.5.7.4.2. EffectVariant Field

The EffectVariant field is used to indicate which variant of the effect, indicated in the EffectIdentifier field, SHOULD be triggered. If the server does not support the given variant, it SHALL use the default variant. This field is dependent on the value of the EffectIdentifier field and SHALL contain one of the non-reserved values listed in [Values of the EffectVariant Field of the OffWithEffect Command](#).

Table 15. Values of the EffectVariant Field of the OffWithEffect Command

EffectIdentifier Field Value	EffectVariant Field Value	Description
0x00	0x00 (default)	Fade to off in 0.8 seconds
	0x01	No fade
	0x02	50% dim down in 0.8 seconds then fade to off in 12 seconds
	0x03 to 0xfe	Reserved
0x01	0x00 (default)	20% dim up in 0.5s then fade to off in 1 second
	0x01 to 0xfe	Reserved
0x02 to 0xfe	0x00 to 0xfe	Reserved

1.5.7.4.3. Effect on Receipt

On receipt of the OffWithEffect command the server SHALL check the value of the GlobalSceneControl attribute.

If the GlobalSceneControl attribute is equal to TRUE, the server SHALL store its settings in its global scene then set the GlobalSceneControl attribute to FALSE, then set the OnOff attribute to FALSE and if the OnTime attribute is supported set the OnTime attribute to 0.

If the GlobalSceneControl attribute is equal to FALSE, the server SHALL only set the OnOff attribute to FALSE.

1.5.7.5. OnWithRecallGlobalScene Command

The OnWithRecallGlobalScene command allows the recall of the settings when the device was turned off.

The OnWithRecallGlobalScene command SHALL have no parameters.

1.5.7.5.1. Effect on Receipt

On receipt of the OnWithRecallGlobalScene command, if the GlobalSceneControl attribute is equal to TRUE, the server SHALL discard the command.

If the GlobalSceneControl attribute is equal to FALSE, the Scene cluster server on the same endpoint SHALL recall its global scene, updating the OnOff attribute accordingly. The OnOff server SHALL then set the GlobalSceneControl attribute to TRUE.

Additionally, when the OnTime and OffWaitTime attributes are both supported, if the value of the OnTime attribute is equal to 0, the server SHALL set the OffWaitTime attribute to 0.

1.5.7.6. OnWithTimedOff Command

The OnWithTimedOff command allows devices to be turned on for a specific duration with a guarded off duration so that SHOULD the device be subsequently turned off, further OnWithTimedOff commands, received during this time, are prevented from turning the devices back on. Further

OnWithTimedOff commands received while the server is turned on, will update the period that the device is turned on.

The OnWithTimedOff command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	OnOffControl	map8	0000 000x			M
1	OnTime	uint16	all	X		M
2	OffWaitTime	uint16	all	X		M

1.5.7.6.1. OnOffControl Field

The OnOffControl field contains information on how the server is to be operated. This field SHALL be formatted as illustrated in [Format of the OnOffControl Field of the OnWithTimedOff Command](#).

Table 16. Format of the OnOffControl Field of the OnWithTimedOff Command

Bit	Description
0	AcceptOnlyWhenOn
1-7	(Reserved)

The AcceptOnlyWhenOn sub-field is 1 bit in length and specifies whether the OnWithTimedOff command is to be processed unconditionally or only when the OnOff attribute is equal to TRUE. If this sub-field is set to 1, the OnWithTimedOff command SHALL only be accepted if the OnOff attribute is equal to TRUE. If this sub-field is set to 0, the OnWithTimedOff command SHALL be processed unconditionally.

1.5.7.6.2. OnTime Field

The OnTime field is used to adjust the value of the OnTime attribute.

1.5.7.6.3. OffWaitTime Field

The OffWaitTime field is used to adjust the value of the OffWaitTime attribute.

1.5.7.6.4. Effect on Receipt

On receipt of this command, if the AcceptOnlyWhenOn sub-field of the OnOffControl field is set to 1, and the value of the OnOff attribute is equal to FALSE, the command SHALL be discarded.

If the value of the OffWaitTime attribute is greater than zero and the value of the OnOff attribute is equal to FALSE, then the server SHALL set the OffWaitTime attribute to the minimum of the OffWaitTime attribute and the value specified in the OffWaitTime field.

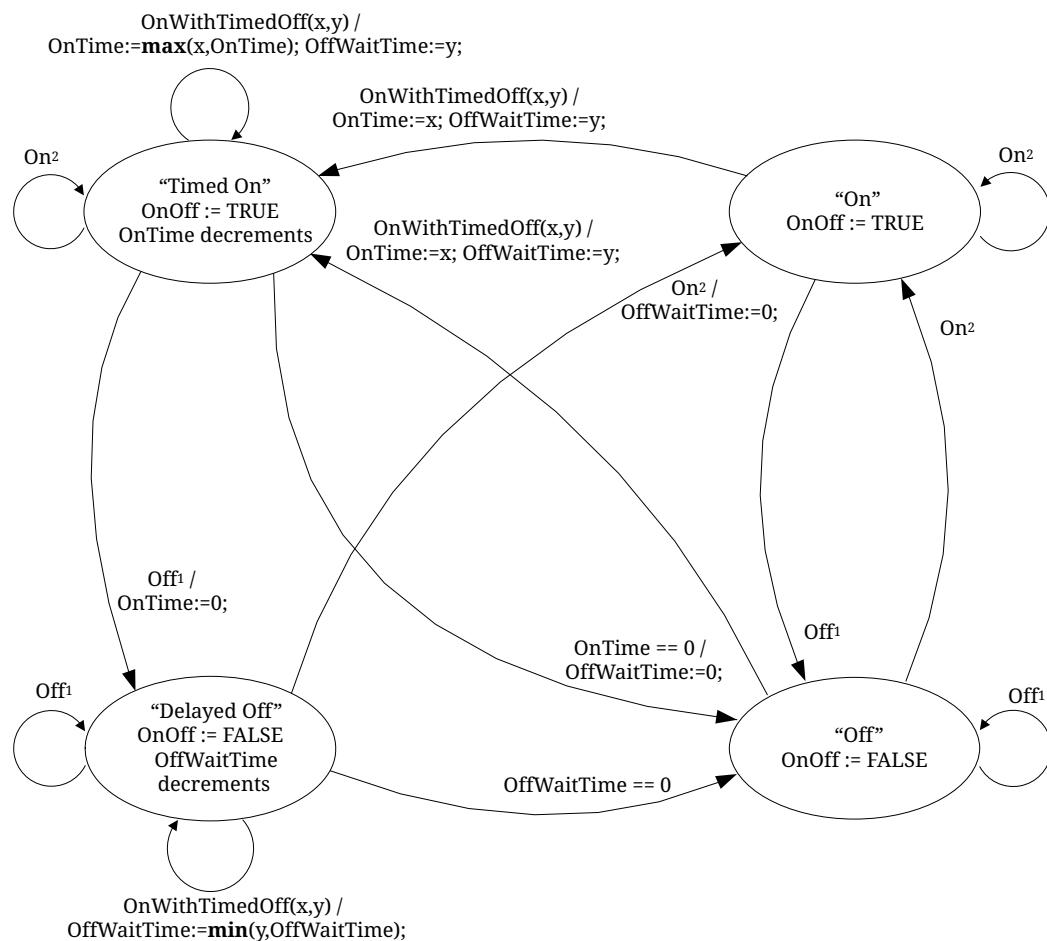
In all other cases, the server SHALL set the OnTime attribute to the maximum of the OnTime attribute and the value specified in the OnTime field, set the OffWaitTime attribute to the value specified in the OffWaitTime field and set the OnOff attribute to TRUE.

If the values of the OnTime and OffWaitTime attributes are both not equal to null, the server SHALL then update these attributes every 1/10th second until both the OnTime and OffWaitTime attributes are equal to 0, as follows:

- If the value of the OnOff attribute is equal to TRUE and the value of the OnTime attribute is greater than zero, the server SHALL decrement the value of the OnTime attribute. If the value of the OnTime attribute reaches 0, the server SHALL set the OffWaitTime and OnOff attributes to 0 and FALSE, respectively.
- If the value of the OnOff attribute is equal to FALSE and the value of the OffWaitTime attribute is greater than zero, the server SHALL decrement the value of the OffWaitTime attribute. If the value of the OffWaitTime attribute reaches 0, the server SHALL terminate the update.

1.5.8. State Description

The operation of the On/Off cluster with respect to the On, Off, and OnWithTimedOff commands is illustrated in [On/Off Cluster Operation State Machine](#). In this diagram, the values X and Y correspond to the OnTime and OffWaitTime fields, respectively, of the OnWithTimedOff command. In the ‘Timed On’ state, the OnTime attribute is decremented every 1/10th second, unless its value equals null. Similarly, in the ‘Delayed Off’ state, the OffWaitTime attribute is decremented every 1/10th second, unless its value equals null.



`Off1`: Any command which causes the OnOff attribute to be set to FALSE, e.g. Off, Toggle or OffWithEffect.
`On2`: Any command which causes the OnOff attribute to be set to TRUE, e.g. On, Toggle or OnWithRecallGlobalScene.

Figure 2. On/Off Cluster Operation State Machine

1.6. Level Control

This cluster provides an interface for controlling a characteristic of a device that can be set to a level, for example the brightness of a light, the degree of closure of a door, or the power output of a heater.

1.6.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	global mandatory ClusterRevision attribute added
2	added Options attribute, state change table; ZLO 1.0; Base cluster (no change) CCB 2085 1775 2281 2147
3	CCB 2574 2616 2659 2702 2814 2818 2819 2898

Rev	Description
4	FeatureMap support with On/Off, Lighting and Frequency features
5	new data model format and notation

1.6.2. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	LVL	Type 1 (client to server)

1.6.3. Cluster Identifiers

Derived cluster specifications are defined elsewhere. This base cluster specification MAY be used for generic level control; however, it is recommended to derive another cluster to better define the application and domain requirements. If one or more derived cluster identifiers and the base identifier exists on a device endpoint, then they SHALL all represent a single instance of the device level control.

Identifier	Hierarchy	Name
0x0008	Base	Level (this cluster specification)
0x0008	Derived	Level Control for Lighting
0x001c	Derived	Pulse Width Modulation

NOTE Pulse Width Modulation cluster is provisional.

1.6.4. Features

This cluster SHALL support the FeatureMap global attribute:

Bit	Code	Name	Def	Description
0	OO	On/Off	1	Dependency with the On/Off cluster
1	LT	Lighting	0	Behavior that supports lighting applications
2	FQ	Fre- quency	0	Supports frequency attributes and behavior. The Pulse Width Modulation cluster was created for frequency control.

The following sections describe each feature in some detail. Further details are found within the specification.

1.6.4.1. On/Off Feature

For many applications, a close relationship between this cluster and the On/Off cluster is needed. This section describes the dependencies that are required when an endpoint that implements this server cluster and also implements the On/Off server cluster. Before the On/Off feature bit in the FeatureMap existed, there was a dependency between this cluster and the On/Off cluster.

The OnOff attribute of the On/Off cluster and the CurrentLevel attribute of the Level Control cluster are intrinsically independent variables, as they are on different clusters. However, when both clusters are implemented on the same endpoint, dependencies MAY be introduced between them. Facilities are provided to introduce dependencies if required.

1.6.4.1.1. Effect of On/Off Commands on the CurrentLevel Attribute

The attribute OnLevel (see [OnLevel Attribute](#)) determines whether commands of the On/Off cluster have a permanent effect on the CurrentLevel attribute or not. If this attribute is defined (i.e., implemented and not equal to null) they do have a permanent effect, otherwise they do not. There is always a temporary effect, due to fading up / down.

The effect on the Level Control cluster on receipt of the various commands of the On/Off cluster are as detailed in [Actions on Receipt for On/Off Commands, when Associated with Level Control](#). In this table, and throughout this cluster specification, 'level' means the value of the CurrentLevel attribute.

Table 17. Actions on Receipt for On/Off Commands, when Associated with Level Control

Command	Action On Receipt
On	Temporarily store CurrentLevel. Set CurrentLevel to the minimum level allowed for the device. Change CurrentLevel to OnLevel, or to the stored level if OnLevel is not defined, over the time period OnOffTransitionTime.
Off	Temporarily store CurrentLevel. Change CurrentLevel to the minimum level allowed for the device over the time period OnOffTransitionTime. If OnLevel is not defined, set the CurrentLevel to the stored level.
Toggle	If the OnOff attribute has the value FALSE, proceed as for the On command. Otherwise proceed as for the Off command.

Intention of the actions described in the table above is that CurrentLevel, which was in effect before any of the On, Off or Toggle commands were issued, SHALL be restored, after the transition is completed. If another of these commands is received, before the transition is completed, the originally stored CurrentLevel SHALL be preserved and restored.

1.6.4.1.2. Effect of Level Control Commands on the OnOff Attribute

There are two sets of commands provided in the Level Control cluster. These are identical, except that the first set (MoveToLevel, Move and Step commands) SHALL NOT affect the OnOff attribute, whereas the second set ('with On/Off' variants) SHALL.

The first set is used to maintain independence between the CurrentLevel and OnOff attributes, so changing CurrentLevel has no effect on the OnOff attribute. As examples, this represents the behavior of a volume control with a separate mute button, or a 'turn to set level and press to turn on/off' light dimmer.

The second set is used to link the CurrentLevel and OnOff attributes. When the level is reduced to its minimum the OnOff attribute is automatically turned to FALSE, and when the level is increased

above its minimum the OnOff attribute is automatically turned to TRUE. As an example, this represents the behavior of a light dimmer with no independent on/off switch.

For the Stop command, the StopWithOnOff is included solely for symmetry, to allow easy choice of one or other set of commands – both Stop commands are identical, because the dependency on On/Off is determined by the original command that is being stopped.

1.6.4.1.3. Effect of Level Control Commands Depends on OnOff

Before the Options attribute was introduced, all commands except those postfixed with ‘with On/Off’, had no effect if the OnOff attribute of the On/Off cluster, on the same endpoint, was FALSE. Even if the On/Off (OO) feature set bit is set to zero, this is still true. To allow such commands to function, please see the Options attribute below.

1.6.4.1.4. GlobalSceneControl and Commands with On/Off

If a MoveToLevel(WithOnOff), Move(WithOnOff) or Step(WithOnOff) command is received that causes a change to the value of the OnOff attribute of the On/Off cluster, the value of the GlobalSceneControl attribute of the On/Off cluster SHALL be updated according to section [GlobalSceneControl Attribute](#).

1.6.4.2. Lighting Feature

This feature supports an interface for controlling the level of a light source.

For the CurrentLevel attribute:

A value of 0x00 SHALL NOT be used.

A value of 0x01 SHALL indicate the minimum level that can be attained on a device.

A value of 0xfe SHALL indicate the maximum level that can be attained on a device.

A value of null SHALL represent an undefined value.

All other values are application specific gradations from the minimum to the maximum level.

1.6.4.3. Frequency Feature

NOTE Frequency feature is provisional.

1.6.5. Attributes

The attributes of the Level Control server cluster are summarized in [Attributes of the Level Control Server Cluster](#).

Table 18. Attributes of the Level Control Server Cluster

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x0000	CurrentLevel	uint8	MinLevel to MaxLevel	SNX	null	R V	M

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x0001	RemainingTime	uint16	all		0	R V	LT
0x0002	MinLevel	uint8	!LT : 0 to MaxLevel LT : 1 to MaxLevel		!LT : 0 LT : 1	R V	O
0x0003	MaxLevel	uint8	MinLevel to 254		254	R V	O
0x0004	CurrentFrequency	uint16	MinFrequency to MaxFrequency	PS	0	R V	FQ
0x0005	MinFrequency	uint16	0 to MaxFrequency		0	R V	FQ
0x0006	MaxFrequency	uint16	MinFrequency to max		0	R V	FQ
0x0010	OnOffTransitionTime	uint16	all		0	RW VO	O
0x0011	OnLevel	uint8	MinLevel to MaxLevel	X	null	RW VO	M
0x0012	OnTransitionTime	uint16	all	X	null	RW VO	O
0x0013	OffTransitionTime	uint16	all	X	null	RW VO	O
0x0014	DefaultMoveRate	uint8	all	X	MS	RW VO	O
0x000F	Options	map8	desc		0	RW VO	M
0x4000	StartUpCurrentLevel	uint8	desc	XN	MS	RW VM	LT

If the Scenes server cluster is implemented on the same endpoint, the following extension fields SHALL be added to the Scene Table in the given order, i.e., the attribute listed as 1 is added first:

1. CurrentLevel
2. CurrentFrequency

Attributes in the scene table that are not supported by the device (according to the FeatureMap attribute) SHALL be present in the scene table but ignored.

OnLevel represents a mandatory field that was previously not present or optional. Implementers should be aware that older devices may not implement it.

1.6.5.1. CurrentLevel Attribute

The CurrentLevel attribute represents the current level of this device. The meaning of 'level' is device dependent.

1.6.5.2. RemainingTime Attribute

The RemainingTime attribute represents the time remaining until the current command is complete - it is specified in 1/10ths of a second.

1.6.5.3. MinLevel Attribute

The MinLevel attribute indicates the minimum value of CurrentLevel that is capable of being assigned.

1.6.5.4. MaxLevel Attribute

The MaxLevel attribute indicates the maximum value of CurrentLevel that is capable of being assigned.

1.6.5.5. CurrentFrequency Attribute

The CurrentFrequency attribute represents the frequency at which the device is at CurrentLevel. A CurrentFrequency of 0 is unknown.

1.6.5.6. MinFrequency Attribute

The MinFrequency attribute indicates the minimum value of CurrentFrequency that is capable of being assigned. MinFrequency SHALL be less than or equal to MaxFrequency. A value of 0 indicates undefined.

1.6.5.7. MaxFrequency Attribute

The MaxFrequency attribute indicates the maximum value of CurrentFrequency that is capable of being assigned. MaxFrequency SHALL be greater than or equal to MinFrequency. A value of 0 indicates undefined.

1.6.5.8. Options Attribute

The Options attribute is meant to be changed only during commissioning. The Options attribute is a bitmap that determines the default behavior of some cluster commands. Each command that is dependent on the Options attribute SHALL first construct a temporary Options bitmap that is in effect during the command processing. The temporary Options bitmap has the same format and meaning as the Options attribute, but includes any bits that may be overridden by command fields.

Below is the format and description of the Options attribute and temporary Options bitmap and the effect on dependent commands.

Table 19. Options Attribute

Bit	Name	Summary Description	Conformance
0	ExecuteIfOff	Dependency on On/Off cluster	LT OO
1	CoupleColorTempToLevel	Dependency on Color Control cluster	LT

1.6.5.8.1. ExecuteIfOff Options Bit

Command execution SHALL NOT continue beyond the Options processing if all of these criteria are true:

- The command is one of the ‘without On/Off’ commands: Move, Move to Level, Step, or Stop.

- The On/Off cluster exists on the same endpoint as this cluster.
- The OnOff attribute of the On/Off cluster, on this endpoint, is FALSE.
- The value of the ExecuteIfOff bit is 0.

1.6.5.8.2. CoupleColorTempToLevel Options Bit

Valid values are:

0 - Do not couple changes to the CurrentLevel attribute with the color temperature.

1 - Couple changes to the CurrentLevel attribute with the color temperature set in the Color Control cluster.

When not supporting the Lighting feature, this bit SHALL be zero and ignored.

1.6.5.9. OnOffTransitionTime Attribute

The OnOffTransitionTime attribute represents the time taken to move to or from the target level when On or Off commands are received by an On/Off cluster on the same endpoint. It is specified in 1/10ths of a second.

The actual time taken SHOULD be as close to OnOffTransitionTime as the device is able. Please note that if the device is not able to move at a variable rate, the OnOffTransitionTime attribute SHOULD NOT be implemented.

1.6.5.10. OnLevel Attribute

The OnLevel attribute determines the value that the CurrentLevel attribute is set to when the OnOff attribute of an On/Off cluster on the same endpoint is set to TRUE, as a result of processing an On/Off cluster command. If the OnLevel attribute is not implemented, or is set to the null value, it has no effect. For more details see [Effect of On/Off Commands on the CurrentLevel Attribute](#).

1.6.5.11. OnTransitionTime Attribute

The OnTransitionTime attribute represents the time taken to move the current level from the minimum level to the maximum level when an On command is received by an On/Off cluster on the same endpoint. It is specified in 10ths of a second. If this attribute is not implemented, or contains a null value, the OnOffTransitionTime will be used instead.

1.6.5.12. OffTransitionTime Attribute

The OffTransitionTime attribute represents the time taken to move the current level from the maximum level to the minimum level when an Off command is received by an On/Off cluster on the same endpoint. It is specified in 10ths of a second. If this attribute is not implemented, or contains a null value, the OnOffTransitionTime will be used instead.

1.6.5.13. DefaultMoveRate Attribute

The DefaultMoveRate attribute determines the movement rate, in units per second, when a Move command is received with a null value Rate parameter.

1.6.5.14. StartUpCurrentLevel Attribute

The StartUpCurrentLevel attribute SHALL define the desired startup level for a device when it is supplied with power and this level SHALL be reflected in the CurrentLevel attribute. The values of the StartUpCurrentLevel attribute are listed below:

Table 20. Values of the StartUpCurrentLevel attribute

Value	Action on power up
0x00	Set the CurrentLevel attribute to the minimum value permitted on the device
null	Set the CurrentLevel attribute to its previous value
other values	Set the CurrentLevel attribute to this value

This behavior does not apply to reboots associated with OTA. After an OTA restart, the CurrentLevel attribute SHALL return to its value prior to the restart.

1.6.6. Commands

The command IDs for the Level Control cluster are listed below.

Table 21. Command IDs for the Level Control Cluster

ID	Name	Direction	Response	Access	Conformance
0x00	MoveToLevel	client ⇒ server	Y	O	M
0x01	Move	client ⇒ server	Y	O	M
0x02	Step	client ⇒ server	Y	O	M
0x03	Stop	client ⇒ server	Y	O	M
0x04	MoveToLevelWithOnOff	client ⇒ server	Y	O	M
0x05	MoveWithOnOff	client ⇒ server	Y	O	M
0x06	StepWithOnOff	client ⇒ server	Y	O	M
0x07	StopWithOnOff	client ⇒ server	Y	O	M
0x08	MoveToClosestFrequency	client ⇒ server	Y	O	FQ

1.6.6.1. MoveToLevel Command

The MoveToLevel command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Level	uint8	0 to 254			M

ID	Name	Type	Constraint	Quality	Default	Conformance
1	TransitionTime	uint16	all	X		M
2	OptionsMask	map8	desc		0	M
3	OptionsOverride	map8	desc		0	M

1.6.6.1.1. Effect on Receipt

The OptionsMask and OptionsOverride fields SHALL both be present. Default values are provided to interpret missing fields from legacy devices. A temporary Options bitmap SHALL be created from the Options attribute, using the OptionsMask and OptionsOverride fields. Each bit of the temporary Options bitmap SHALL be determined as follows:

Each bit in the Options attribute SHALL determine the corresponding bit in the temporary Options bitmap, unless the OptionsMask field is present and has the corresponding bit set to 1, in which case the corresponding bit in the OptionsOverride field SHALL determine the corresponding bit in the temporary Options bitmap.

The resulting temporary Options bitmap SHALL then be processed as defined in section [Options Attribute](#).

On receipt of this command, a device SHALL move from its current level to the value given in the Level field. The meaning of 'level' is device dependent – e.g., for a light it MAY mean brightness level.

The movement SHALL be as continuous as technically practical, i.e., not a step function, and the time taken to move to the new level SHALL be equal to the value of the TransitionTime field, in tenths of a second, or as close to this as the device is able.

If the TransitionTime field takes the value null then the time taken to move to the new level SHALL instead be determined by the OnOffTransitionTime attribute. If OnOffTransitionTime, which is an optional attribute, is not present, the device SHALL move to its new level as fast as it is able.

If the device is not able to move at a variable rate, the TransitionTime field MAY be disregarded.

1.6.6.2. Move Command

The Move command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	MoveMode	enum8	desc			M
1	Rate	uint8	all	X		M
2	OptionsMask	map8	desc		0	M
3	OptionsOverride	map8	desc		0	M

1.6.6.2.1. MoveMode Field

The MoveMode field SHALL be one of the non-reserved values in [Values of the MoveMode Field](#).

Table 22. Values of the MoveMode Field

MoveMode Value	Description
0x00	Up
0x01	Down

1.6.6.2.2. Rate Field

The Rate field specifies the rate of movement in units per second. The actual rate of movement SHOULD be as close to this rate as the device is able. If the Rate field is equal to null, then the value in DefaultMoveRate attribute SHALL be used. However, if the Rate field is equal to null and the DefaultMoveRate attribute is not supported, or if the Rate field is equal to null and the value of the DefaultMoveRate attribute is equal to null, then the device SHOULD move as fast as it is able. If the device is not able to move at a variable rate, this field MAY be disregarded.

1.6.6.2.3. Effect on Receipt

On receipt of this command, a device SHALL first create and process a temporary Options bitmap as described in section [Effect on Receipt](#).

On receipt of this command, a device SHALL move from its current level in an up or down direction in a continuous fashion, as detailed in [Actions on Receipt for Move Command](#).

Table 23. Actions on Receipt for Move Command

MoveMode	Action on Receipt
Up	Increase the device's level at the rate given in the Rate field. If the level reaches the maximum allowed for the device, stop.
Down	Decrease the device's level at the rate given in the Rate field. If the level reaches the minimum allowed for the device, stop.

1.6.6.3. Step Command

The Step command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	StepMode	enum8	desc			M
1	StepSize	uint8	all			M
2	TransitionTime	uint16	all	X		M
3	OptionsMask	map8	desc		0	M
4	OptionsOverride	map8	desc		0	M

The StepMode field SHALL be one of the non-reserved values in [Values of the StepMode Field](#).

Table 24. Values of the StepMode Field

StepMode Value	Description
0x00	Up
0x01	Down

The TransitionTime field specifies the time that SHALL be taken to perform the step, in tenths of a second. A step is a change in the CurrentLevel of StepSize units. The actual time taken SHOULD be as close to this as the device is able. If the TransitionTime field is equal to null, the device SHOULD move as fast as it is able.

If the device is not able to move at a variable rate, the TransitionTime field MAY be disregarded.

1.6.6.3.1. Effect on Receipt

On receipt of this command, a device SHALL first create and process a temporary Options bitmap as described in section [Effect on Receipt](#).

On receipt of this command, a device SHALL move from its current level in an up or down direction as detailed in [Actions on Receipt for Step Command](#).

Table 25. Actions on Receipt for Step Command

StepMode	Action on Receipt
Up	Increase CurrentLevel by StepSize units, or until it reaches the maximum level allowed for the device if this reached in the process. In the latter case, the transition time SHALL be proportionally reduced.
Down	Decrease CurrentLevel by StepSize units, or until it reaches the minimum level allowed for the device if this reached in the process. In the latter case, the transition time SHALL be proportionally reduced.

1.6.6.4. Stop Command

The Stop command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	OptionsMask	map8	desc		0	M
1	OptionsOverride	map8	desc		0	M

1.6.6.4.1. Effect of Receipt

On receipt of this command, a device SHALL first create and process a temporary Options bitmap as described in section [Effect on Receipt](#).

Upon receipt of this command, any MoveToLevel, Move or Step command (and their 'with On/Off' variants) currently in process SHALL be terminated. The value of CurrentLevel SHALL be left at its value upon receipt of the Stop command, and RemainingTime SHALL be set to zero.

This command has two entries in [Command IDs for the Level Control Cluster](#), one for the MoveToLevel, Move and Step commands, and one for their 'with On/Off' counterparts. This is solely for symmetry, to allow easy choice of one or other set of commands – the Stop commands are identical, because the dependency on On/Off is determined by the original command that is being stopped.

1.6.6.5. MoveToClosestFrequency Command

The MoveToClosestFrequency command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Frequency	uint16	all		0	M

1.6.6.5.1. Effect of Receipt

Upon receipt of this command, the device SHALL change its current frequency to the requested frequency, or to the closest frequency that it can generate. If the device cannot approximate the frequency, then it SHALL return a default response with an error code of CONSTRAINT_ERROR. Determining if a requested frequency can be approximated by a supported frequency is a manufacturer-specific decision.

1.6.6.6. 'With On/Off' Commands

The MoveToLevelWithOnOff, MoveWithOnOff and StepWithOnOff commands have identical data fields compared to the MoveToLevel, Move and Step commands respectively. They also have the same effects, except for the following additions.

Before commencing any command that has the effect of setting the CurrentLevel attribute above the minimum level allowed by the device, the OnOff attribute of the On/Off cluster on the same endpoint, if implemented, SHALL be set to TRUE ('On').

If any command that has the effect of setting the CurrentLevel attribute to the minimum level allowed by the device, the OnOff attribute of the On/Off cluster on the same endpoint, if implemented, SHALL be set to FALSE ('Off').

The StopWithOnOff command has identical data fields compared to the Stop command. Both Stop commands are identical, because the dependency on On/Off is determined by the original command that is being stopped.

1.6.7. State Change Table for Lighting

Below is a table of examples of state changes when Level Control and On/Off clusters are on the same endpoint and the Lighting feature is set.

EiO - ExecuteIfOff field in the Options attribute

OnOff – attribute value of On/Off cluster: FALSE=‘Off’, TRUE=‘On’

MIN - MinLevel

MAX - MaxLevel

MID – midpoint between MinLevel and MaxLevel

Table 26. Lighting Device State Change

Cur- rentLevel	EiO	OnOff	Physical Device	Com- mand Before After	Cur- rentLevel	OnOff	Physical Device	Device Output Result
any	0	FALSE	Off	Move- ToLevel(l =MID, t=2 sec)	same	FALSE	Off	stays off
any	0	FALSE	Off	Move- ToLevel- With- OnOff(l= MID, t=2 sec)	MID	TRUE	On (mid- point bright- ness)	turns on and out- put level adjusts or stays at half
any	1	FALSE	Off	Move- ToLevel(l =MID, t=2 sec)	MID	FALSE	Off	stays off
any	1	FALSE	Off	Move- ToLevel- With- OnOff(l= MID, t=2 sec)	MID	TRUE	On	turns on and out- put level adjusts to or stays at half
any	1	FALSE	Off	Move(up, rate=64/s)	MAX	FALSE	Off	stays off
any	1	FALSE	Off	Move- With- OnOff(up, rate=64/s)	MAX	TRUE	On	turn on and out- put level adjusts to or stays at full
any	1	FALSE	Off	Move- With- OnOff(do wn, rate=64/s)	MIN	FALSE	Off	stays off

<i>any</i>	<i>any</i>	TRUE	On (any brightness)	Move-ToLevel-With-OnOff(l= <i>MID</i> , t=2 sec)	<i>MID</i>	TRUE	On (mid-point brightness)	output level adjusts to or stays at half
<i>any</i>	<i>any</i>	TRUE	On (any brightness)	Move-With-OnOff(up, rate=64/s)	<i>MAX</i>	TRUE	On (full brightness)	output level adjusts to or stays at full
<i>any</i>	<i>any</i>	TRUE	On (any brightness)	Move(down, rate=64/s)	<i>MIN</i>	TRUE	On (at minimum brightness)	output level adjusts to minimum
<i>any</i>	<i>any</i>	TRUE	On (any brightness)	Move-With-OnOff(down, rate=64/s)	<i>MIN</i>	FALSE	Off	output level adjusts to off

1.7. Boolean State

This cluster provides an interface to a boolean state called StateValue.

1.7.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial release

1.7.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Type 2	BOOL

1.7.3. Cluster Identifiers

ID	Name	Meaning of StateValue
0x0045	Boolean State	current value of a boolean state variable

The semantics of this boolean state are defined by the device type using this cluster. For example, in a Contact Sensor device type, FALSE=open or no contact, TRUE=closed or contact.

1.7.4. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	StateValue	bool		P		R V	M

1.7.4.1. StateValue Attribute

This represents a Boolean state.

1.7.5. Events

ID	Name	Priority	Access	Conformance
0	StateChange	INFO	V	O

1.7.5.1. StateChange Event

This event SHALL be generated when the StateValue attribute changes.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	StateValue	bool				M

The StateValue field SHALL indicate the new value of the StateValue attribute.

1.8. Mode Select

This cluster provides an interface for controlling a characteristic of a device that can be set to one of several predefined values. For example, the light pattern of a disco ball, the mode of a massage chair, or the wash cycle of a laundry machine.

The server allows the client to set a mode on the server. A mode is one of a list of options that may be presented by a client for a user choice, or understood by the client, via the semantic tags on the mode.

A semantic tag is either a standard tag within a standard category namespace, or a manufacturer specific tag, within the namespace of the vendor ID of the manufacturer. If there is no semantic tag, the mode is anonymous, and the selection is made by the user solely based on the Label string.

Each cluster ID that indicates this specification SHALL define a distinct purpose for the cluster instance. For example: A LightBlinking cluster ID supports blinking modes for a light (and is described that way).

An anonymous mode SHALL support the derived cluster purpose. A manufacturer specific seman-

tic tag SHALL support the derived cluster purpose. An anonymous mode SHALL NOT replace the meaning of a standard semantic tag, when one exists, for the cluster purpose.

1.8.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	Initial version

1.8.2. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	MOD	Type 1 (client to server)

1.8.3. Cluster Identifiers

ID	Name
0x0050	Mode Select

1.8.4. Features

This cluster SHALL support the FeatureMap global attribute:

ID	Code	Name	Description
0	DEPONOFF	On/Off	Dependency with the On/Off cluster

1.8.4.1. On/Off Feature

This feature creates a dependency between an On/Off cluster instance and this cluster instance on the same endpoint. See [OnMode Attribute](#) for more information.

1.8.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Description	string	max 64	F	MS	R V	M
0x0001	Standard-Namespace	enum16	desc	FX	null	R V	M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0002	Supported-Modes	list[ModeOptionStruct]	max 255	F	MS	R V	M
0x0003	Current-Mode	uint8	desc	SN	MS	R V	M
0x0004	StartUp-Mode	uint8	desc	NX	MS	RW VO	O
0x0005	OnMode	uint8	desc	NX	null	RW VO	DEPONOFF

If the Scenes server cluster is implemented on the same endpoint, the following extension field SHALL be added to the Scene Table:

- CurrentMode

1.8.5.1. Description Attribute

This attribute describes the purpose of the server, in readable text.

For example, a coffee machine may have a Mode Select cluster for the amount of milk to add, and another Mode Select cluster for the amount of sugar to add. In this case, the first instance can have the description **Milk** and the second instance can have the description **Sugar**. This allows the user to tell the purpose of each of the instances.

1.8.5.2. StandardNamespace Attribute

This attribute, when not null, SHALL indicate a single standard namespace for any standard semantic tag value supported in this or any other cluster instance with the same value of this attribute. A null value indicates no standard namespace, and therefore, no standard semantic tags are provided in this cluster instance. Each standard namespace and corresponding values and value meanings SHALL be defined in another document.

1.8.5.3. SupportedModes Attribute

This attribute is the list of supported modes that may be selected for the CurrentMode attribute. Each item in this list represents a unique mode as indicated by the Mode field of the ModeOptionStruct. Each entry in this list SHALL have a unique value for the Mode field.

1.8.5.4. CurrentMode Attribute

This attribute represents the current mode of the server.

The value of this field must match the Mode field of one of the entries in the **SupportedModes** attribute.

1.8.5.5. StartUpMode Attribute

The StartUpMode attribute value indicates the desired startup mode for the server when it is supplied with power.

If this attribute is not null, the CurrentMode attribute SHALL be set to the StartUpMode value, when the server is powered up, except in the case when the [OnMode attribute overrides the StartUpMode attribute](#).

This behavior does not apply to reboots associated with OTA. After an OTA restart, the CurrentMode attribute SHALL return to its value prior to the restart.

The value of this field SHALL match the Mode field of one of the entries in the [SupportedModes](#) attribute.

If this attribute is not implemented, or is set to the null value, it SHALL have no effect.

1.8.5.6. OnMode Attribute

This attribute SHALL indicate the value of CurrentMode that depends on the state of the On/Off cluster on the same endpoint. If this attribute is not present or is set to null, it SHALL NOT have an effect, otherwise the CurrentMode attribute SHALL depend on the OnOff attribute of the On/Off cluster as described in the table below:

OnOff Change	CurrentMode Change
ON → OFF	No change
OFF → ON	Change CurrentMode to OnMode
OFF → OFF	No change
ON → ON	No change

The value of this field SHALL match the Mode field of one of the entries in the [SupportedModes](#) attribute.

1.8.5.6.1. OnMode with Power Up

If the On/Off feature is supported and the On/Off cluster attribute [StartUpOnOff](#) is present, with a value of On (turn on at power up), then the CurrentMode attribute SHALL be set to the OnMode attribute value when the server is supplied with power, except if the OnMode attribute is null.

1.8.6. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	ChangeToMode	client ⇒ server	Y	O	M

1.8.6.1. ChangeToMode Command

On receipt of this command, if the [NewMode](#) field indicates a valid mode transition within the supported list, the server SHALL set the [CurrentMode](#) attribute to the [NewMode](#) value, otherwise, the

server SHALL respond with an **INVALID_COMMAND** status response.

Id	Name	Type	Constraint	Quality	Default	Conformance
0	NewMode	uint8	desc			M

1.8.7. Events

This cluster has no events.

1.8.8. Data Types

1.8.8.1. ModeOptionStruct

This is a struct representing a possible mode of the server.

Id	Name	Type	Constraint	Quality	Access	Default	Conformance
0	Label	string	max 64	F	R	MS	M
1	Mode	uint8		F	R	MS	M
2	Semantic-Tags	list[Semantic-TagStruct]	max 64	F	R	MS	M

1.8.8.1.1. Label Field

This field is readable text that describes the mode option that can be used by a client to indicate to the user what this option means. This field is meant to be readable and understandable by the user.

1.8.8.1.2. Mode Field

The Mode field is used to identify the mode option. The value SHALL be unique for every item in the SupportedModes attribute.

1.8.8.1.3. SemanticTags Field

This field is a list of semantic tags that map to the mode option. This MAY be used by clients to determine the meaning of the mode option as defined in a standard or manufacturer specific namespace. Semantic tags can help clients look for options that meet certain criteria. A semantic tag SHALL be either a standard tag or manufacturer specific tag as defined in each [Semantic-TagStruct](#) list entry.

A mode option MAY have more than one semantic tag. A mode option MAY be mapped to a mixture of standard and manufacturer specific semantic tags.

All standard semantic tags are from a single namespace indicated by the StandardNamespace attribute.

For example: A mode labeled "100%" can have both the **HIGH** (MS) and **MAX** (standard) semantic tag. Clients seeking the option for either **HIGH** or **MAX** will find the same option in this case.

1.8.8.2. SemanticTagStruct

A Semantic Tag is meant to be interpreted by the client for the purpose the cluster serves.

Id	Name	Type	Constraint	Quality	Access	Default	Conformance
0	MfgCode	vendor-id	desc	FX	R		M
1	Value	enum16	all	F	R		M

1.8.8.2.1. Value Field

This field SHALL indicate the semantic tag within a semantic tag namespace which is either manufacturer specific or standard. For semantic tags in a standard namespace, see [Standard Namespace](#).

1.8.8.2.2. MfgCode Field

If this field is null, the Value field SHALL be defined in a standard namespace as indicated by the StandardNamespace attribute. If this field is not null, it SHALL indicate a manufacturer code (Vendor ID), and the Value field SHALL indicate a semantic tag defined by the manufacturer. Each manufacturer code supports a single namespace of values. The same manufacturer code and semantic tag value in separate cluster instances are part of the same namespace and have the same meaning. For example: a manufacturer tag meaning "pinch", has the same meaning in a cluster whose purpose is to choose the amount of sugar, or amount of salt.

1.9. Low Power

This cluster provides an interface for managing low power mode on a device.

1.9.1. Overview

This cluster would be supported on an endpoint that represents a physical device with a low power mode. This cluster provides a sleep() command to allow clients to manually put the device into low power mode. There is no command here to wake up a sleeping device because that operation often involves other protocols such as [Wake On LAN](#). Most devices automatically enter low power mode based upon inactivity.

The cluster server for Low Power is implemented by a device that supports a low power mode, such as a TV, Set-top box, or Smart Speaker.

NOTE we have considered a "DisableLowPowerMode" command but have not added it due to suspected issues with energy consumption regulations. This can be added in the future.

1.9.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

1.9.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	LOWPOWER

1.9.1.3. Cluster Identifiers

Identifier	Name
0x0508	Low Power

1.9.2. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance

1.9.3. Commands

Id	Name	Direction	Response	Access	Conformance
0x00	Sleep	Client ⇒ Server	Y	O	M

1.9.3.1. Sleep

This command shall put the device into low power mode.

1.10. Wake On LAN

This cluster provides an interface for managing low power mode on a device that supports the Wake On LAN or Wake On Wireless LAN (WLAN) protocol (see [Wake On LAN]).

1.10.1. Overview

This cluster would be supported on IP devices that have a low power mode AND support the ability to be woken up using the Wake on LAN or Wake on WLAN protocol. This cluster provides the device MAC address which is a required input to the Wake on LAN protocol. Besides the MAC address, this cluster provides an optional link-local IPv6 address which is useful to support "Wake on Direct Packet" used by some Ethernet and Wi-Fi devices.

Acting on the MAC address or link-local IPv6 address information does require the caller to be in

the same broadcast domain as the destination. To wake the destination up, the caller sends a multi-cast-based magic UDP packet that contains destination's MAC address in the UDP payload to FF02::1, the IPv6 all-nodes link-local multicast group address. If the optional link-local address is provided by the destination through this cluster, the caller also sends the magic UDP packet in unicast to that link-local address. This unicast-based method is particularly useful for Wi-Fi devices, since due to lack of MAC layer retransmission mechanism, multicast over Wi-Fi is not as reliable as unicast. If a device provides the link-local address in this cluster, its Ethernet controller or Wi-Fi radio shall respond to the IPv6 neighbor solicitation message for the link-local address without the need to wake host CPU up. In order to receive the magic or neighbor solicitation packets in multicast, the Wi-Fi devices must support Group Temporal Key (GTK) rekey operation in low power mode.

Most devices automatically enter low power mode based upon inactivity.

The cluster server for Wake on LAN or Wake on WLAN is implemented by a device that supports the Wake on LAN/WLAN protocol, such as a TV, Set-top Box, or Smart Speaker.

1.10.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
i-sio-n	
1	Initial Release

1.10.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	WAKEONLAN

1.10.1.3. Cluster Identifiers

Identifier	Name
0x0503	Wake on LAN

1.10.2. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	MACAddress	hwadr	desc	F		R V	O

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0001	LinkLocalAddress	ipv6addr	desc	F		R V	O

1.10.2.1. MACAddress Attribute

This SHALL indicate the current MAC address of the device. Only 48-bit MAC Addresses SHALL be used for this attribute as required by the Wake on LAN protocol.

1.10.2.2. LinkLocalAddress Attribute

This SHALL indicate the current link-local address of the device. Only 128-bit IPv6 link-local addresses SHALL be used for this attribute.

NOTE Some companies may consider MAC Address to be protected data subject to PII handling considerations and will therefore choose not to include it or read it. The MAC Address can often be determined using ARP in IPv4 or NDP in IPv6.

1.11. Switch

This cluster exposes interactions with a switch device, for the purpose of using those interactions by other devices.

Two types of switch devices are supported: latching switch (e.g. rocker switch) and momentary switch (e.g. push button), distinguished with their feature flags.

Interactions with the switch device are exposed as attributes (for the latching switch) and as events (for both types of switches).

An interested client MAY subscribe to these attributes/events and thus be informed of the interactions, and can perform actions based on this, for example by sending commands to perform an action such as controlling a light or a window shade.

1.11.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

1.11.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	SWTCH

1.11.3. Cluster Identifiers

Identifier	Name
0x003b	Switch

1.11.4. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below. These feature flags SHALL be used to indicate the physics as well as the detection/reporting capabilities of the device represented by the cluster, and hence the attributes and events exposed.

Bit	Code	Feature	Conformance
0	LS	Latching Switch	O.a
1	MS	Momentary Switch	O.a
2	MSR	Momentary Switch Release	[MS]
3	MSL	Momentary Switch LongPress	[MS & MSR]
4	MSM	Momentary Switch MultiPress	[MS & MSR]

As indicated in the table, a server SHALL support exactly one of **LS** or the **MS** feature flags to reflect the type of switch it represents.

1.11.4.1. Latching Switch

This feature is for a switch that maintains its position after being pressed (or turned).

1.11.4.2. Momentary Switch

This feature is for a switch that does not maintain its position after being pressed (or turned). After releasing, it goes back to its idle position.

1.11.4.3. Momentary Switch Release

This feature is for a momentary switch that can distinguish and report release events. When this feature flag **MSR** is present, **MS** SHALL be present as well.

1.11.4.4. Momentary Switch LongPress

This feature is for a momentary switch that can distinguish and report long presses from short presses. When this feature flag **MSL** is present, **MS** and **MSR** SHALL be present as well.

1.11.4.5. Momentary Switch MultiPress

This feature is for a momentary switch that can distinguish and report double press and potentially multiple presses with more events, such as triple press, etc. When this feature flag **MSM** is present, **MS**

and **MSR** SHALL be present as well.

1.11.5. Attributes

Id	Name	Type	Constraint	Qual- ity	Defau- lt	Acces- s	Con- for- manc- e
0x0000	NumberOfPositions	uint8	2 to max	F	2	R	M
0x0001	CurrentPosition	uint8	0 to NumberOfPositions-1	N	0	R	M
0x0002	MultiPressMax	uint8	2 to max	F	2	R	MSM

1.11.5.1. NumberOfPositions Attribute

This attribute SHALL indicate the maximum number of positions the switch has. Any kind of switch has a minimum of 2 positions. Also see [Section 1.11.10, “NumberOfPositions > 2”](#) for the case NumberOfPositions>2.

1.11.5.2. CurrentPosition Attribute

This attribute SHALL indicate the position of the switch. The valid range is zero to NumberOfPositions-1. CurrentPosition value 0 SHALL be assigned to the default position of the switch: for example the "open" state of a rocker switch, or the "idle" state of a push button switch.

1.11.5.3. MultiPressMax Attribute

This attribute SHALL indicate how many consecutive presses can be detected and reported by a momentary switch which supports multi-press (e.g. it will report the value 3 if it can detect single press, double press and triple press, but not quad press and beyond).

1.11.6. Commands

This cluster has no commands.

1.11.7. Events

This cluster SHALL support these events:

Id	Name	Access	Conformance
0	SwitchLatched	V	LS
1	InitialPress	V	MS
2	LongPress	V	MSL
3	ShortRelease	V	MSR

Id	Name	Access	Conformance
4	LongRelease	V	MSL
5	MultiPressOngoing	V	MSM
6	MultiPressComplete	V	MSM

1.11.7.1. SwitchLatched Event

This event SHALL be generated, when the latching switch is moved to a new position. It MAY have been delayed by debouncing within the switch.

The data of this event SHALL contain the following information:

Id	Name	Type	Constraint	Qual- ity	Defaul t	Con- for- mance
0	NewPosition	uint8	0 to NumberOfPositions -1			M

The **NewPosition** field SHALL indicate the new value of the CurrentPosition attribute, i.e. after the move.

1.11.7.2. InitialPress Event

This event SHALL be generated, when the momentary switch starts to be pressed (after debouncing).

The data of this event SHALL contain the following information:

Id	Name	Type	Constraint	Qual- ity	Defaul t	Con- for- mance
0	NewPosition	uint8	0 to NumberOfPositions -1			M

The **NewPosition** field SHALL indicate the new value of the CurrentPosition attribute, i.e. while pressed.

1.11.7.3. LongPress Event

This event SHALL be generated, when the momentary switch has been pressed for a "long" time (this time interval is manufacturer determined (e.g. since it depends on the switch physics)).

The data of this event SHALL contain the following information:

Id	Name	Type	Constraint	Qual- ity	Defaul t	Con- for- mance
0	NewPosition	uint8	0 to NumberOfPositions -1			M

The **NewPosition** field SHALL indicate the new value of the CurrentPosition attribute, i.e. while pressed.

1.11.7.4. ShortRelease Event

This event SHALL be generated, when the momentary switch has been released (after debouncing).

- If the server supports the Momentary Switch LongPress (MSL) feature, this event SHALL be generated when the switch is released if **no LongPress** event had been generated since the previous **InitialPress** event.
- If the server does not support the Momentary Switch LongPress (MSL) feature, this event SHALL be generated when the switch is released - even when the switch was pressed for a long time.
- Also see [Section 1.11.8, “Sequence of generated events”](#).

The data of this event SHALL contain the following information:

Id	Name	Type	Constraint	Qual- ity	Defaul t	Con- for- mance
0	PreviousPosition	uint8	0 to NumberOfPositions-1			M

The **PreviousPosition** field SHALL indicate the previous value of the CurrentPosition attribute, i.e. just prior to release.

1.11.7.5. LongRelease Event

This event SHALL be generated, when the momentary switch has been released (after debouncing) and after having been pressed for a long time, i.e. this event SHALL be generated when the switch is released if a **LongPress** event has been generated since the previous **InitialPress** event. Also see [Section 1.11.8, “Sequence of generated events”](#).

The data of this event SHALL contain the following information:

Id	Name	Type	Constraint	Qual- ity	Defaul t	Con- for- mance
0	PreviousPosition	uint8	0 to NumberOfPositions-1			M

The **PreviousPosition** field SHALL indicate the previous value of the CurrentPosition attribute, i.e. just prior to release.

1.11.7.6. MultiPressOngoing Event

This event SHALL be generated to indicate how many times the momentary switch has been pressed in a multi-press sequence, *during* that sequence. See [Section 1.11.9, “Sequence of events for MultiPress”](#) below.

The data of this event SHALL contain the following information:

Id	Name	Type	Constraint	Qual- ity	Defau- lt	Con- for- mance
0	NewPosition	uint8	0 to NumberOfPositions-1			M
1	CurrentNumberOf- PressesCounted	uint8	2 to MultiPressMax			M

The **NewPosition** field SHALL indicate the new value of the CurrentPosition attribute, i.e. while pressed.

The **CurrentNumberOfPressesCounted** field SHALL contain:

- a value of 2 when the second press of a multi-press sequence has been detected,
- a value of 3 when the third press of a multi-press sequence has been detected,
- a value of N when the Nth press of a multi-press sequence has been detected.

1.11.7.7. MultiPressComplete Event

This event SHALL be generated to indicate how many times the momentary switch has been pressed in a multi-press sequence, after it has been detected that the sequence has *ended*. See [Section 1.11.9, “Sequence of events for MultiPress”](#) below.

The data of this event SHALL contain the following information:

Id	Name	Type	Constraint	Qual- ity	Defau- lt	Confor- mance
0	PreviousPosition	uint8	0 to NumberOfPositions-1			M
1	TotalNumberOfPress- esCounted	uint8	1 to MultiPressMax			M

The **PreviousPosition** field SHALL indicate the previous value of the CurrentPosition attribute, i.e. just prior to release.

The **TotalNumberOfPressesCounted** field SHALL contain:

- a value of 1 when there was one press in a multi-press sequence (and the sequence has ended), i.e. there was no double press (or more),
- a value of 2 when there were exactly two presses in a multi-press sequence (and the sequence has ended),
- a value of 3 when there were exactly three presses in a multi-press sequence (and the sequence has ended),
- a value of N when there were exactly N presses in a multi-press sequence (and the sequence has ended).

1.11.8. Sequence of generated events

This section describes the sequence of events that will be generated by three types of momentary switches (distinguished by their feature flags). For each switch type, we will define the sequence of generated events for these three interactions:

1. Sequence for a switch which is pressed briefly.
2. Sequence for a switch pressed for a long time.
3. Sequence for a switch pressed for a very long time.

In the three interactions described in the subsections below, if the `NumberOfPositions` attribute is equal to 2, the `InitialPress` and `LongPress` events have the `NewPosition` field set to 1 and the `ShortRelease` and `LongRelease` events have the `PreviousPosition` field set to 1. For larger values of the `NumberOfPositions` attribute, see [Section 1.11.10, “`NumberOfPositions > 2`”](#).

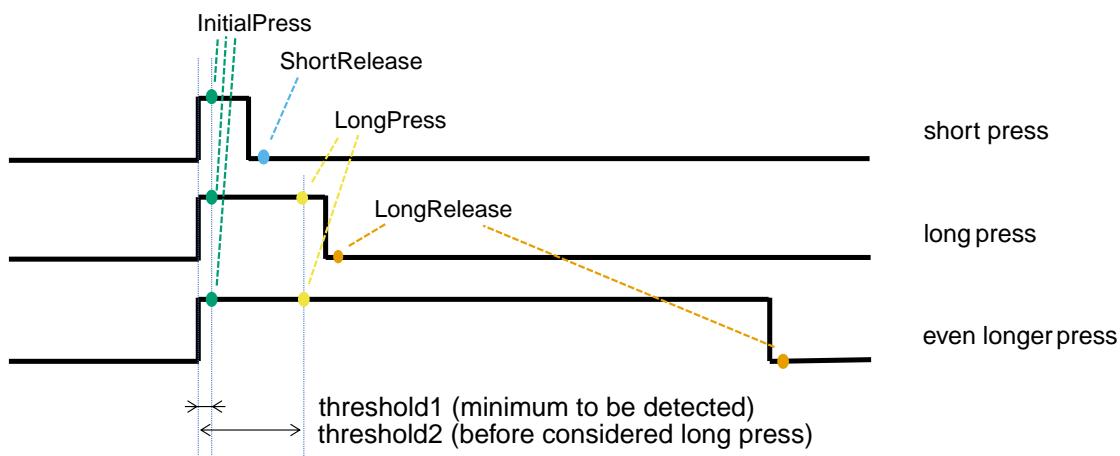
1.11.8.1. Supports `InitialPress` + `LongPress` + `ShortRelease` + `LongRelease`

This switch (with feature flags `MS` & `MSR` & `MSL`) SHALL generate either a sequence of two or three (depending on how long the switch is pressed) events for one interaction cycle, in the order given below and illustrated in the figure below.

- short press: `InitialPress`, then `ShortRelease`
- long press (or very long press): `InitialPress`, then `LongPress`, and finally `LongRelease`. Please note that the `LongPress` event SHALL be generated exactly once for this case and SHALL not be repeated, irrespective how long the switch is pressed.

The image shows a time representation of the state of the switch (low=not pressed, high=pressed) with the colored dots indicating the various events generated at that moment in time.

feature flags: MS & MSR & MSL



*Figure 3. Switch device delivering 'InitialPress', 'LongPress' and both '*Release' events*

1.11.8.2. Supports InitialPress + ShortRelease (but not LongPress, LongRelease)

This switch (with feature flags **MS** & **MSR** & **!MSL**) does not generate events for the "longpress" case and therefore it SHALL generate a sequence of two events for one interaction cycle, irrespective of how long the switch is pressed, in the order given and illustrated below.

- any press length: **InitialPress**, then **ShortRelease**

Please note that even after a "long" period being pressed, the release event is **ShortRelease**. A device with this set of feature flags SHALL NOT generate the **LongPress** and **LongRelease** events.

feature flags: **MS** & **MSR** & **!MSL**

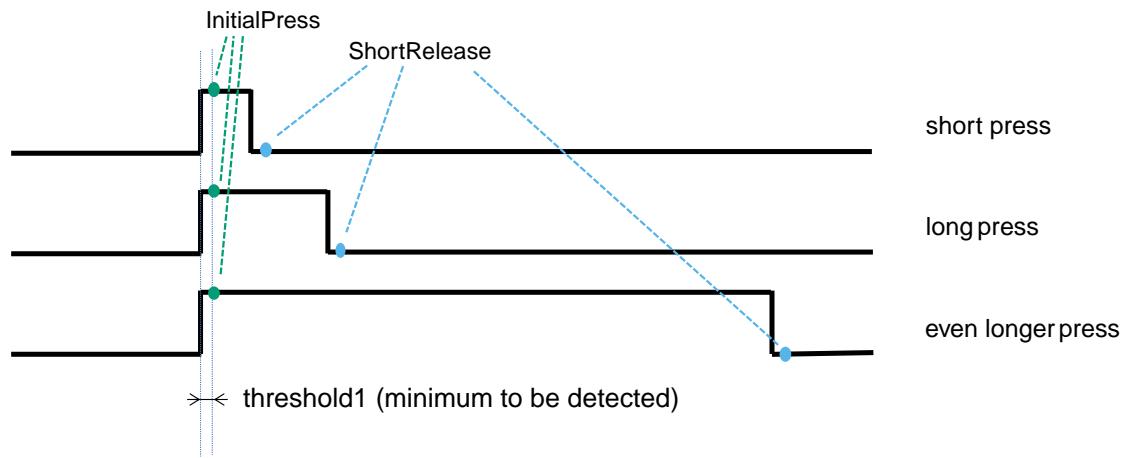


Figure 4. Switch device delivering only 'InitialPress' and 'ShortRelease' events

1.11.8.3. Supports InitialPress (but not LongPress, ShortRelease and LongRelease)

This switch (with feature flags **MS** & **!MSR** & **!MSL**) SHALL generate a single **InitialPress** event for one interaction cycle, irrespective of how long the switch is pressed, as illustrated in the figure below.

A device with this set of feature flags SHALL NOT generate any of the **ShortRelease**, **LongPress** and **LongRelease** events.

feature flags: MS & !MSR & !MSL

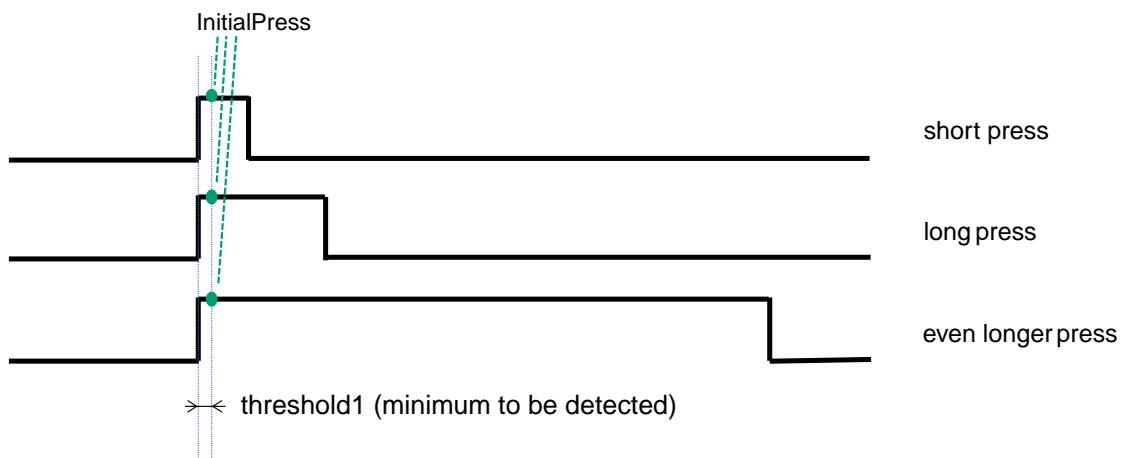


Figure 5. Switch device delivering only 'InitialPress' events

1.11.9. Sequence of events for MultiPress

Multi-press detection is a feature of momentary switches (indicated with feature flag **MSM**) that they can count and report sequences of press-release cycles within a certain time frame, for example to indicate that the user has pressed the switch once, twice or three (or even more) times in succession. The definition of the time window for this detection is manufacturer-specific since it depends on the switch physics. The maximum number of presses which can be detected and reported SHALL be indicated in attribute **MultiPressMax**. The minimum value and default value for **MultiPressMax** are both 2.

A switch supporting MultiPress SHALL set feature flags **MS** & **MSR** & **MSM**, and optionally also feature flag **MSL**. It SHALL generate the **MultiPressOngoing** and **MultiPressFinished** events in *addition* to the other events defined for momentary switches (i.e. **InitialPress**, **ShortRelease**, and in case of **MSL**, **LongPress** and **LongRelease**).

The **MultiPressOngoing** event is provided for parties interested in keeping track of the actual presses during the multi-press sequence. The **MultiPressComplete** event is provided for parties interested in the outcome of the whole sequence: after the multi-press sequence has ended, they will receive the **MultiPressComplete** event indicating how many times the switch was pressed.

In the figure below, three sequences of user interaction are indicated:

- single press sequence: after the press and release moments, the **InitialPress** and **ShortRelease** events SHALL be generated. After some further time, when the switch has detected that there is no second press, it SHALL generate **MultiPressComplete(1)** since it has detected that the sequence consisted of one press. No **MultiPressOngoing** event SHALL be generated for this case.
- double press sequence: after each of the press and release moments, the **InitialPress** and **ShortRelease** events SHALL be generated. Additionally, when the switch is pressed for the second time, the **MultiPressOngoing(2)** event SHALL be generated, as the switch has detected the second press. Note that this event coincides with the second **InitialPress** event; both SHALL be generated. After some further time, when the switch has detected that there is no third press, it SHALL generate **MultiPressComplete(2)** since it has detected that the sequence consisted of two

presses.

- third press sequence: after each press and release moments, the **InitialPress** and **ShortRelease** events SHALL be generated. Additionally, when the switch is pressed for the second time, the **MultiPressOngoing(2)** event SHALL be generated, as the switch has detected the second press. Note that this event coincides with the second **InitialPress** event; both SHALL be generated. Additionally, when the switch is pressed for the third time, the **MultiPressOngoing(3)** event SHALL be generated, as the switch has detected the third press. Note that this event coincides with the third **InitialPress** event; both SHALL be generated. After some further time, when the switch has detected that there is no fourth press, it SHALL generate **MultiPressComplete(3)** since it has detected that the sequence consisted of three presses.

For the above cases where multiple events need to be generated at the same time, the **MultiPressOngoing** event SHALL be generated directly after the **InitialPress** event.

NOTE The numbers in parentheses in the bulleted text above and in the figure below indicate the value of the **CurrentNumberOfPressesCounted** resp. **TotalNumberOfPressesCounted** field in the event data.

NOTE As with the other figures, sufficient debounce time needs to be taken into account for the detection of press and release events. This is included in the figure, and has been left out of the description above for readability, but SHALL be applied.

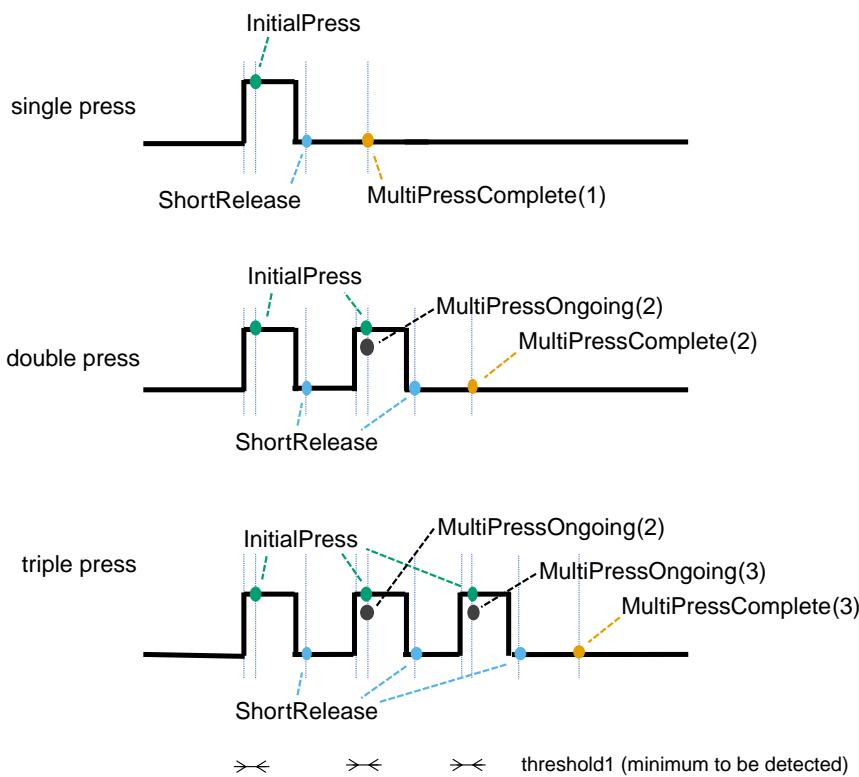


Figure 6. Switch device with multi-press events

1.11.10. NumberOfPositions > 2

This section will discuss some archetypes of switch devices with more than 2 positions and how they SHALL set attribute values and generate events matching their characteristics.

For the **SwitchLatched**, **InitialPress**, **LongPress** and **MultiPressOngoing** events, the field **NewPosition** SHALL be set to the value corresponding to the new position to which the switch was moved. For the **ShortRelease**, **LongRelease** and **MultiPressComplete** events, the field **PreviousPosition** SHALL be set to the value corresponding to the position of the switch just preceding the (latest) release.

1.11.10.1. Latching Switch with N stable positions (N>2) with fixed sequence

With such a device, the user can move the switch from a position M to positions M-1 and M+1 (either with a wraparound between the end positions, or fixed stop at the end positions).

On each interaction with the switch device, it SHALL generate a **SwitchLatched** event with the **NewPosition** field set to the value associated with the new position.

Due to the physical constraints, such an event will have a **NewPosition** field which is equal to the previous **NewPosition** field plus or minus 1 (modulo **NumPositions** if the switch does not have end stops).

In a first example, a switch has 3 positions, associated with values 0, 1 and 2. In this case, wrap-around is not possible: from position 0 it can only be moved to position 1.

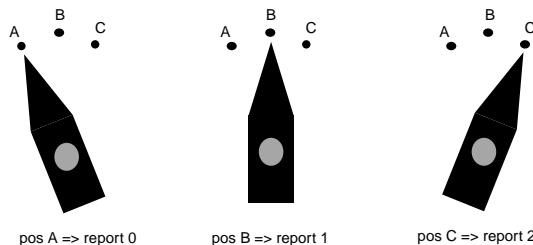


Figure 7. Rotary switch device with 3 positions

In another example, a switch has 8 positions, associated with values 0 through 7. In this case, the physics of the switch allow wraparound: from position 0 it can be moved to position 1 or to position 7.

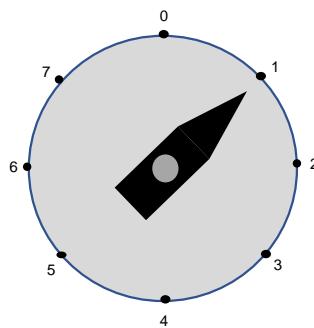


Figure 8. Rotary switch device with 8 positions and wraparound

1.11.10.2. Latching Switch with N stable positions ($N > 2$) with random sequence (example: radio buttons)

With such a device, the user can press any of the available buttons, so this switch does not show the incrementing or decrementing behavior of **NewPosition** which we discussed for the latching switch with fixed sequence. In the example in the figure below, the 5 buttons are labelled "A" through "E" for the user and are associated with values 0 through 4. The user first presses the "A" button, and the switch device generates a **SwitchLatched** event with **NewPosition** set to 0. Then the user first presses the "D" button, and the switch device generates a **SwitchLatched** event with **NewPosition** set to 4.

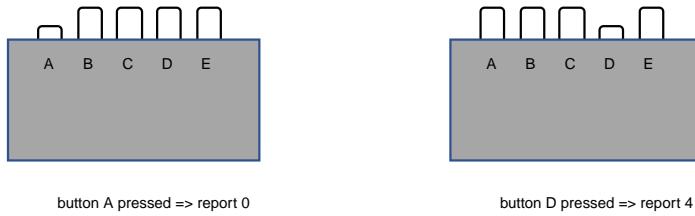


Figure 9. Switch device with radio buttons

1.11.10.3. Momentary Switch with 2 or more non-stable positions

For a Momentary Switch with more than 1 stable position, it depends on the physics of the switch device which sequence of events will be generated.

NOTE

In this section we will mention only the **InitialPress** and **ShortRelease** events. The switch device could also generate the other events defined above for a momentary switch, depending on the capabilities of the switch device and the interaction with the switch device.

The first variant (figure below, example: up/down control for window blinds) shows a switch in neutral position (left figure) which corresponds to **CurrentPosition=0**. The user can press the top

side (position value 1) or the bottom side (position value 2). It is not possible to go directly from position 1 to position 2 or vice versa - the switch will always need to go through the neutral position 0.

So when the user presses the top side of the switch, the `InitialPress (NewPosition=1)` event will be generated. When they release the top side, the `ShortRelease (PreviousPosition=1)` event will be generated. The user continues to press the bottom side, and the event `InitialPress (NewPosition=2)` is generated. Upon release of the bottom side, the event `ShortRelease (PreviousPosition=2)` is generated.

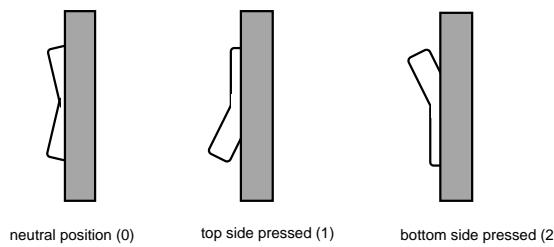


Figure 10. Up/down control switch device

Another variant (figure below, example: joystick) has a control handle with a neutral position in the middle (left figure) which corresponds to `CurrentPosition=0`. The handle can be moved along the dotted lines.

In the middle figure, the user moves the handle to the East position and then releases it (which makes it return to the neutral middle position). This generates this sequence of events:

```
InitialPress (NewPosition=3)      // move to East
ShortRelease (PreviousPosition=3) // back to middle (from East)
```

In the righthand figure, the user moves the handle to the SouthWest position, then to the South position and then releases it (which makes it return to the neutral middle position). This generates this sequence of events:

```
InitialPress (NewPosition=6)      // move to SouthWest
InitialPress (NewPosition=5)      // move to South
ShortRelease (PreviousPosition=5) // back to middle (from South)
```

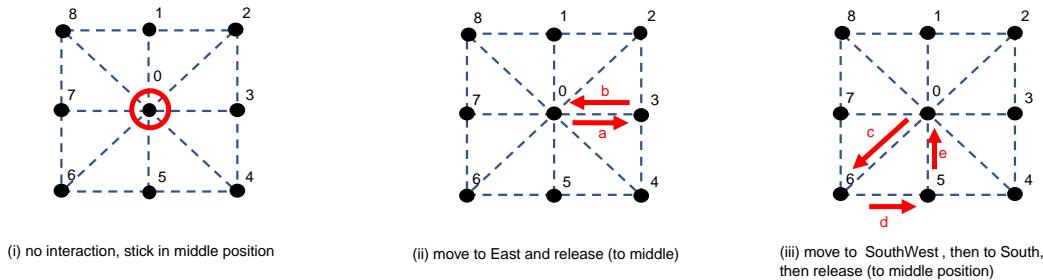


Figure 11. Switch device with joystick

Therefore, in the "joystick" variation, there could be a succession of **InitialPress** events without an intermediate **ShortRelease** events - unlike the "window blinds control" variation which will always have such an intermediate **ShortRelease** event.

Chapter 2. Measurement and Sensing

The Cluster Library is made of individual chapters such as this one. See Document Control in the Cluster Library for a list of all chapters and documents. References between chapters are made using a *X.Y* notation where *X* is the chapter and *Y* is the sub-section within that chapter. References to external documents are contained in Chapter 1 and are made using [*Rn*] notation.

2.1. General Description

2.1.1. Introduction

The clusters specified in this document are generic measurement and sensing interfaces that are sufficiently general to be of use across a wide range of application domains.

2.1.2. Cluster List

This section lists the measurement and sensing clusters as specified in this chapter.

Table 27. Overview of the Measurement and Sensing Clusters

Cluster ID	Cluster Name	Description
0x0400	Illuminance Measurement	Attributes and commands for configuring the measurement of illuminance, and reporting illuminance measurements
0x0402	Temperature Measurement	Attributes and commands for configuring the measurement of temperature, and reporting temperature measurements
0x0403	Pressure Measurement	Attributes and commands for configuring the measurement of pressure, and reporting pressure measurements
0x0404	Flow Measurement	Attributes and commands for configuring the measurement of flow, and reporting flow rates
0x0405	Relative Humidity Measurement	Supports configuring the measurement of relative humidity, and reporting relative humidity measurements of water in the air

Cluster ID	Cluster Name	Description
0x0407	Leaf Wetness Measurement	Supports configuring the measurement of relative humidity, and reporting relative humidity measurements of water on the leaves of plants
0x0408	Soil Moisture Measurement	Supports configuring the measurement of relative humidity, and reporting relative humidity measurements of water in the soil
0x0406	Occupancy Sensing	Attributes and commands for configuring occupancy sensing, and reporting occupancy status

2.1.3. Measured Value

This section provides requirements on the attributes `MeasuredValue`, `MinMeasuredValue`, `MaxMeasuredValue`, `Tolerance` as used in various clusters defined in this chapter.

2.1.3.1. Constraint

Where `MinMeasuredValue` or `MaxMeasuredValue` attributes are mandatory the null value MAY be used to indicate that a limit is unknown.

For any measurement cluster with `MeasuredValue`, `MinMeasuredValue` and `MaxMeasuredValue` attributes, the following SHALL be always be true:

- If `MinMeasuredValue` and `MaxMeasuredValue` are both known, then `MaxMeasuredValue` SHALL be greater than `MinMeasuredValue`.
- If `MaxMeasuredValue` is known, then `MeasuredValue` SHALL be less than or equal to `MaxMeasuredValue`.
- If `MinMeasuredValue` is known, then `MeasuredValue` SHALL be greater than or equal to `MinMeasuredValue`.

2.1.3.2. Tolerance

For any measurement cluster with a `MeasuredValue` and `Tolerance` attribute, when `Tolerance` is implemented the following SHALL always be true:

- The `Tolerance` attribute SHALL indicate the magnitude of the possible error that is associated with `MeasuredValue` attribute, using the same units and resolution. The true value SHALL be in the range (`MeasuredValue` – `Tolerance`) to (`MeasuredValue` + `Tolerance`).
- If known, the true value SHALL never be outside the possible physical range. Some examples:
 - a temperature SHALL NOT be below absolute zero
 - a concentration SHALL NOT be negative

2.2. Illuminance Measurement

2.2.1. Introduction

The Illuminance Measurement cluster provides an interface to illuminance measurement functionality, including configuration and provision of notifications of illuminance measurements.

2.2.2. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	mandatory global ClusterRevision attribute added; CCB 2048 2049 2050
2	CCB 2167
3	new data model format and notation

2.2.3. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	ILL	Type 2 (server to client)

2.2.4. Cluster Identifiers

Identifier	Name
0x0400	Illuminance Measurement

2.2.5. Attributes

The Illuminance Measurement attributes are summarized in [Illuminance Measurement Attributes](#).

Table 28. Illuminance Measurement Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	MeasuredValue	uint16	0, MinMeasuredValue to MaxMeasuredValue	PX	0	R V	M
0x0001	MinMeasuredValue	uint16	1 to MaxMeasuredValue-1	X		R V	M
0x0002	MaxMeasuredValue	uint16	MinMeasuredValue+1 to 65534	X		R V	M
0x0003	Tolerance	uint16	0 to 2048			R V	O

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0004	LightSensorType	enum8	all	X	null	R V	O

2.2.5.1. MeasuredValue Attribute

The MeasuredValue attribute represents the illuminance in Lux (symbol lx) as follows:

- MeasuredValue = $10,000 \times \log_{10}(\text{illuminance}) + 1$,

where $1 \text{ lx} \leq \text{illuminance} \leq 3.576 \text{ Mlx}$, corresponding to a MeasuredValue in the range 1 to 0xffff.

The MeasuredValue attribute can take the following values:

- 0 indicates a value of illuminance that is too low to be measured,
- MinMeasuredValue ≤ MeasuredValue ≤ MaxMeasuredValue under normal circumstances,
- null indicates that the illuminance measurement is invalid.

The MeasuredValue attribute is updated continuously as new measurements are made.

2.2.5.2. MinMeasuredValue Attribute

The MinMeasuredValue attribute indicates the minimum value of MeasuredValue that can be measured. A value of null indicates that this attribute is not defined. See [Measured Value](#) for more details.

2.2.5.3. MaxMeasuredValue Attribute

The MaxMeasuredValue attribute indicates the maximum value of MeasuredValue that can be measured. A value of null indicates that this attribute is not defined. See [Measured Value](#) for more details.

2.2.5.4. Tolerance Attribute

See [Measured Value](#).

2.2.5.5. LightSensorType Attribute

The LightSensorType attribute specifies the electronic type of the light sensor. This attribute shall be set to one of the non-reserved values listed in [Values of the LightSensorType Attribute](#).

Table 29. Values of the LightSensorType Attribute

Value	Description
0	Photodiode
1	CMOS
0x40 to 0xfe	Reserved for manufacturer specific light sensor types
null	Unknown

2.2.6. Commands

This cluster has no cluster specific commands.

2.3. Temperature Measurement

This cluster provides an interface to temperature measurement functionality, including configuration and provision of notifications of temperature measurements.

2.3.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	mandatory global ClusterRevision attribute added
2	CCB 2241 2370
3	CCB 2823
4	New data model format and notation

2.3.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Type 2 (server to client)	TMP

2.3.3. Cluster Identifiers

Identifier	Name
0x0402	Temperature Measurement

2.3.4. Attributes

Table 30. Temperature Measurement Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Measured-Value	int16	MinMeasuredValue to MaxMeasuredValue	XP		R V	M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0001	MinMeasuredValue	int16	-27315 to MaxMeasuredValue-1	X		R V	M
0x0002	MaxMeasuredValue	int16	MinMeasuredValue+1 to 32767	X		R V	M
0x0003	Tolerance	uint16	0 to 2048		0	R V	O

2.3.4.1. MeasuredValue Attribute

Represents the temperature in degrees Celsius as follows:

$$\text{MeasuredValue} = 100 \times \text{temperature } [{}^{\circ}\text{C}]$$

Where $-273.15^{\circ}\text{C} \leq \text{temperature} \leq 327.67^{\circ}\text{C}$, with a resolution of 0.01°C .

The null value indicates that the temperature is unknown.

2.3.4.2. MinMeasuredValue Attribute

The MinMeasuredValue attribute indicates the minimum value of MeasuredValue that is capable of being measured. See [Measured Value](#) for more details.

The null value indicates that the value is not available.

2.3.4.3. MaxMeasuredValue Attribute

The MaxMeasuredValue attribute indicates the maximum value of MeasuredValue that is capable of being measured. See [Measured Value](#) for more details.

The null value indicates that the value is not available.

2.3.4.4. Tolerance Attribute

See [Measured Value](#).

2.3.5. Commands

This cluster has no cluster specific commands.

2.4. Pressure Measurement

This cluster provides an interface to pressure measurement functionality, including configuration and provision of notifications of pressure measurements.

2.4.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Mandatory global ClusterRevision attribute added
2	CCB 2241 2370
3	New data model format and notation

2.4.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Type 2 (server to client)	PRS

2.4.3. Cluster Identifiers

Identifier	Name
0x0403	Pressure Measurement

2.4.4. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description	Conformance
0	EXT	Extended	The cluster is capable of extended range and resolution	O

2.4.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Measured-Value	int16	MinMeasuredValue to MaxMeasuredValue	XP		R V	M
0x0001	MinMeasuredValue	int16	-32767 to MaxMeasured-Value-1	X		R V	M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0002	MaxMeasuredValue	int16	MinMeasuredValue+1 to 32767	X		R V	M
0x0003	Tolerance	uint16	0 to 2048		0	R V	O
0x0010	ScaledValue	int16	MinScaledValue to MaxScaledValue	X	0	R V	EXT
0x0011	MinScaledValue	int16	-32767 to MaxScaledValue-1	X	0	R V	EXT
0x0012	MaxScaledValue	int16	MinScaledValue+1 to 32767	X	0	R V	EXT
0x0013	ScaledTolerance	uint16	0 to 2048		0	R V	[EXT]
0x0014	Scale	int8	-127 to 127		0	R V	EXT

2.4.5.1. MeasuredValue Attribute

This attribute represents the pressure in kPa as follows:

$$\text{MeasuredValue} = 10 \times \text{Pressure [kPa]}$$

The null value indicates that the value is not available.

2.4.5.2. MinMeasuredValue Attribute

This attribute indicates the minimum value of MeasuredValue that can be measured. See [Measured Value](#) for more details.

The null value indicates that the value is not available.

2.4.5.3. MaxMeasuredValue Attribute

This attribute indicates the maximum value of MeasuredValue that can be measured. See [Measured Value](#) for more details.

The null value indicates that the value is not available.

2.4.5.4. Tolerance Attribute

This attribute indicates the magnitude of the possible error that is associated with ScaledValue.

See [Measured Value](#).

2.4.5.5. ScaledValue Attribute

ScaledValue represents the pressure in Pascals as follows:

$$\text{ScaledValue} = 10^{\text{Scale}} \times \text{Pressure [Pa]}$$

The null value indicates that the value is not available.

2.4.5.6. MinScaledValue Attribute

The MinScaledValue attribute indicates the minimum value of ScaledValue that can be measured.

The null value indicates that the value is not available.

2.4.5.7. MaxScaledValue Attribute

This attribute indicates the maximum value of ScaledValue that can be measured.

MaxScaledValue SHALL be greater than MinScaledValue.

The null value indicates that the value is not available.

2.4.5.8. ScaledTolerance Attribute

This attribute indicates the magnitude of the possible error that is associated with ScaledValue. The true value is located in the range

(ScaledValue – ScaledTolerance) to (ScaledValue + ScaledTolerance).

2.4.5.9. Scale Attribute

This attribute indicates the base 10 exponent used to obtain ScaledValue (see [ScaledValue Attribute](#)).

2.4.6. Commands

This cluster has no cluster specific commands.

2.5. Flow Measurement

This cluster provides an interface to flow measurement functionality, including configuration and provision of notifications of flow measurements.

2.5.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Mandatory global ClusterRevision attribute added
2	CCB 2241 2370
3	New data model format and notation

2.5.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Type 2 (server to client)	FLW

2.5.3. Cluster Identifiers

Identifier	Name
0x0404	Flow Measurement

2.5.4. Attributes

The Flow Measurement Information attribute set contains the attributes summarized in the following table.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Measured-Value	uint16	MinMeasuredValue to MaxMeasuredValue	XP	null	R V	M
0x0001	MinMeasuredValue	uint16	0 to MaxMeasured-Value-1	X		R V	M
0x0002	MaxMeasuredValue	uint16	MinMeasured-Value+1 to 65534	X		R V	M
0x0003	Tolerance	uint16	0 to 2048		0	R V	O

2.5.4.1. MeasuredValue Attribute

MeasuredValue represents the flow in m^3/h as follows:

$$\text{MeasuredValue} = 10 \times \text{Flow}$$

The null value indicates that the flow measurement is unknown, otherwise the range SHALL be as described in [Measured Value](#).

2.5.4.2. MinMeasuredValue Attribute

The MinMeasuredValue attribute indicates the minimum value of MeasuredValue that can be measured. See [Measured Value](#) for more details.

The null value indicates that the value is not available.

2.5.4.3. MaxMeasuredValue Attribute

The MaxMeasuredValue attribute indicates the maximum value of MeasuredValue that can be measured. See [Measured Value](#) for more details.

The null value indicates that the value is not available.

2.5.4.4. Tolerance Attribute

See [Measured Value](#).

2.5.5. Commands

This cluster has no cluster specific commands.

2.6. Water Content Measurement

This is a base cluster. The server cluster provides an interface to water content measurement functionality. The measurement is reportable and may be configured for reporting. Water content measurements include, but are not limited to, leaf wetness, relative humidity, and soil moisture.

2.6.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Mandatory global ClusterRevision attribute added
2	CCB 2241
3	New data model format and notation

2.6.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	RH

2.6.3. Cluster Identifiers

Identifier	Name	Description
0x0405	Relative Humidity Measurement	Percentage of water in the air
0x0407	Leaf Wetness Measurement	Percentage of water on the leaves of plants
0x0408	Soil Moisture Measurement	Percentage of water in the soil

2.6.4. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	MeasuredValue	uint16	MinMeasuredValue to MaxMeasuredValue	XP		R V	M
0x0001	MinMeasuredValue	uint16	0 to MaxMeasuredValue-1	X		R V	M
0x0002	MaxMeasuredValue	uint16	MinMeasuredValue+1 to 10000	X		R V	M
0x0003	Tolerance	uint16	0 to 2048			R V	O

2.6.4.1. MeasuredValue Attribute

MeasuredValue represents the water content in % as follows:

$$\text{MeasuredValue} = 100 \times \text{water content}$$

Where $0\% \leq \text{water content} \leq 100\%$, corresponding to a MeasuredValue in the range 0 to 10000.

The maximum resolution this format allows is 0.01%.

MinMeasuredValue and MaxMeasuredValue define the range of the sensor.

The null value indicates that the measurement is unknown, otherwise the range SHALL be as described in [Measured Value](#).

MeasuredValue is updated continuously as new measurements are made.

2.6.4.2. MinMeasuredValue Attribute

The MinMeasuredValue attribute indicates the minimum value of MeasuredValue that can be measured. The null value means this attribute is not defined. See [Measured Value](#) for more details.

2.6.4.3. MaxMeasuredValue Attribute

The MaxMeasuredValue attribute indicates the maximum value of MeasuredValue that can be measured. The null value means this attribute is not defined. See [Measured Value](#) for more details.

2.6.4.4. Tolerance Attribute

See [Measured Value](#).

2.6.5. Commands

This cluster has no cluster specific commands.

2.7. Occupancy Sensing

2.7.1. Introduction

The server cluster provides an interface to occupancy sensing functionality, including configuration and provision of notifications of occupancy status.

2.7.2. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	mandatory global ClusterRevision attribute added
2	Physical Contact Occupancy feature with mandatory OccupancySensorTypeBitmap
3	new data model format and notation

2.7.3. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	OCC	Type 2 (server to client)

2.7.4. Cluster Identifiers

Identifier	Name
0x0406	Occupancy Sensing

2.7.5. Data Types

2.7.5.1. OccupancyBitmap

This data type is derived from bitmap8.

Bit	Name	Summary	Conformance
0	Occupied	Indicates the sensed occupancy state; 1 = occupied, 0 = unoccupied.	M

All other bits are reserved.

2.7.5.2. OccupancySensorTypeEnum

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	PIR	Indicates a passive infrared sensor.	M
1	Ultrasonic	Indicates a ultrasonic sensor.	M
2	PIRAndUltrasonic	Indicates a passive infrared and ultrasonic sensor.	M
3	PhysicalContact	Indicates a physical contact sensor.	M

2.7.5.3. OccupancySensorTypeBitmap

This data type is derived from bitmap8.

Bit	Name	Summary	Conformance
0	PIR	Indicates a passive infrared sensor.	M
1	Ultrasonic	Indicates a ultrasonic sensor.	M
2	PhysicalContact	Indicates a physical contact sensor.	M

2.7.6. Occupancy Sensor Information Attribute Set

For convenience, the attributes defined in this specification are arranged into sets of related attributes.

The occupancy sensor information attribute set contains the attributes summarized in [Occupancy Sensor Information Attribute Set](#).

Table 31. Occupancy Sensor Information Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Occupancy	OccupancyBitmap	0b0000 000x	P		R V	M
0x0001	OccupancySensorType	OccupancySensorType-Enum	desc		MS	R V	M
0x0002	OccupancySensorTypeBitmap	OccupancySensorTypeBitmap	0b0000 0xxx			R V	M

2.7.6.1. Occupancy Attribute

The Occupancy attribute indicates the status of occupancy.

2.7.6.2. OccupancySensorType Attribute

The OccupancySensorType attribute specifies the type of the occupancy sensor.

2.7.6.3. OccupancySensorTypeBitmap Attribute

The OccupancySensorTypeBitmap attribute specifies the types of the occupancy sensor. A ‘1’ in each bit position indicates the capability is implemented.

The value of the OccupancySensorTypeBitmap attribute and the OccupancySensorType attribute SHALL be aligned as defined below.

Table 32. Mapping between OccupancySensorTypeBitmap and OccupancySensorType Attributes

OccupancySensorTypeBitmap	OccupancySensorType
PIR	PIR
Ultrasonic	Ultrasonic
PIR + Ultrasonic	PIRAndUltrasonic
PhysicalContact	PhysicalContact
PhysicalContact + PIR	PIR
PhysicalContact + Ultrasonic	Ultrasonic
PhysicalContact + PIR + Ultrasonic	PIRAndUltrasonic

2.7.7. PIR Configuration Attribute Set

The PIR sensor configuration attribute set contains the attributes summarized in [Attributes of the PIR Configuration Attribute Set](#).

Table 33. Attributes of the PIR Configuration Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0010	PIROccupiedToUnoccupiedDelay	uint16	all		0	RW VM	O
0x0011	PIRUNoccupiedToOccupiedDelay	uint16	all		0	RW VM	O
0x0012	PIRUNoccupiedToOccupiedThreshold	uint8	1 to 254		1	RW VM	O

2.7.7.1. PIROccupiedToUnoccupiedDelay Attribute

The PIROccupiedToUnoccupiedDelay attribute specifies the time delay, in seconds, before the PIR sensor changes to its unoccupied state after the last detection of movement in the sensed area.

2.7.7.2. PIRUnoccupiedToOccupiedDelay Attribute

The PIRUnoccupiedToOccupiedDelay attribute specifies the time delay, in seconds, before the PIR sensor changes to its occupied state after the detection of movement in the sensed area. This attribute is mandatory if the PIRUnoccupiedToOccupiedThreshold attribute is implemented.

2.7.7.3. PIRUnoccupiedToOccupiedThreshold Attribute

The PIRUnoccupiedToOccupiedThreshold attribute specifies the number of movement detection events that must occur in the period PIRUnoccupiedToOccupiedDelay, before the PIR sensor changes to its occupied state. This attribute is mandatory if the PIRUnoccupiedToOccupiedDelay attribute is implemented.

2.7.8. Ultrasonic Configuration Attribute Set

The ultrasonic sensor configuration attribute set contains the attributes summarized in [Attributes of the Ultrasonic Configuration Attribute Set](#).

Table 34. Attributes of the Ultrasonic Configuration Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0020	UltrasonicOccupiedToUnoccupiedDelay	uint16	all		0	RW VM	O
0x0021	UltrasonicUnoccupiedToOccupiedDelay	uint16	all		0	RW VM	O
0x0022	UltrasonicUnoccupiedToOccupiedThreshold	uint8	1 to 254		1	RW VM	O

2.7.8.1. UltrasonicOccupiedToUnoccupiedDelay Attribute

The UltrasonicOccupiedToUnoccupiedDelay attribute and specifies the time delay, in seconds, before the Ultrasonic sensor changes to its unoccupied state after the last detection of movement in the sensed area.

2.7.8.2. UltrasonicUnoccupiedToOccupiedDelay Attribute

The UltrasonicUnoccupiedToOccupiedDelay attribute and specifies the time delay, in seconds, before the Ultrasonic sensor changes to its occupied state after the detection of movement in the sensed area. This attribute is mandatory if the UltrasonicUnoccupiedToOccupiedThreshold attribute is implemented.

2.7.8.3. UltrasonicUnoccupiedToOccupiedThreshold Attribute

The UltrasonicUnoccupiedToOccupiedThreshold attribute specifies the number of movement detection events that must occur in the period UltrasonicUnoccupiedToOccupiedDelay, before the Ultrasonic sensor changes to its occupied state. This attribute is mandatory if the UltrasonicUnoccupiedToOccupiedDelay attribute is implemented.

2.7.9. Physical Contact Configuration Attribute Set

The physical contact configuration attribute set contains the attributes summarized below.

Table 35. Attributes of the Physical Contact Configuration Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0030	Physical-ContactOccupiedToUnoccupiedDelay	uint16	all	X	0	RW VM	O
0x0031	Physical-ContactUnoccupiedToOccupiedDelay	uint16	all	X	0	RW VM	O
0x0032	Physical-ContactUnoccupiedToOccupiedThreshold	uint8	1 to 254		1	RW VM	O

2.7.9.1. PhysicalContactOccupiedToUnoccupiedDelay Attribute

The PhysicalContactOccupiedToUnoccupiedDelay attribute specifies the time delay, in seconds, before the physical contact occupancy sensor changes to its unoccupied state after detecting the unoccupied event. The null value indicates that the sensor does not report occupied to unoccupied transition.

2.7.9.2. PhysicalContactUnoccupiedToOccupiedDelay Attribute

The PhysicalContactUnoccupiedToOccupiedDelay attribute specifies the time delay, in seconds, before the physical contact sensor changes to its occupied state after the detection of the occupied event.

The null value indicates that the sensor does not report unoccupied to occupied transition.

2.7.9.3. PhysicalContactUnoccupiedToOccupiedThreshold Attribute

The PhysicalContactUnoccupiedToOccupiedThreshold attribute specifies the number of movement detection events that must occur in the period PhysicalContactUnoccupiedToOccupiedDelay, before the PIR sensor changes to its occupied state. This attribute is mandatory if the PhysicalContactUnoccupiedToOccupiedDelay attribute is implemented.

2.7.10. Commands

This cluster has no cluster specific commands.

Chapter 3. Lighting

The Cluster Library is made of individual chapters such as this one. See Document Control in the Cluster Library for a list of all chapters and documents. References between chapters are made using a *X.Y* notation where *X* is the chapter and *Y* is the sub-section within that chapter. References to external documents are contained in Chapter 1 and are made using [*Rn*] notation.

3.1. General Description

3.1.1. Introduction

The clusters specified in this document are for use typically in lighting applications, but MAY be used in any application domain.

3.1.2. Terms

Ballast Factor: A measure of the light output (lumens) of a ballast and lamp combination in comparison to an ANSI standard ballast operated with the same lamp. Multiply the ballast factor by the rated lumens of the lamp to get the light output of the lamp/ballast combination.

HSV: Hue, Saturation, Value. A color space, also known as HSB (Hue, Saturation, Brightness). This is a well-known transformation of the RGB (Red, Green, Blue) color space. For more information see e.g., http://en.wikipedia.org/wiki/HSV_color_space.

Illuminance: The density of incident luminous flux on a surface. Illuminance is the standard metric for lighting levels, and is measured in lux (lx).

3.1.3. Cluster List

This section lists the lighting specific clusters as specified in this chapter.

Table 36. Overview of the Lighting Specific Clusters

ID	Cluster Name	Description
0x0300	Color Control	Attributes and commands for controlling the color of a color-capable light.
0x0301	Ballast Configuration	Attributes and commands for configuring a lighting ballast

3.2. Color Control Cluster

3.2.1. Introduction

This cluster provides an interface for changing the color of a light. Color is specified according to the Commission Internationale de l'Éclairage (CIE) specification CIE 1931 Color Space, [I1]. Color control is carried out in terms of x,y values, as defined by this specification.

Additionally, color MAY optionally be controlled in terms of color temperature, or as hue and saturation values based on optionally variable RGB and W color points. It is recommended that the hue and saturation are interpreted according to the HSV (aka HSB) color model.

Control over luminance is not included, as this is provided by means of the Level Control for Lighting cluster. It is recommended that the level provided by this cluster be interpreted as representing a proportion of the maximum intensity achievable at the current color.

3.2.2. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	mandatory global ClusterRevision attribute added; CCB 2028
2	added Options attribute, CCB 2085 2104 2124 2230; ZLO 1.0
3	CCB 2501 2814 2839 2840 2843 2861
4	All Hubs changes
5	new data model format and notation, FeatureMap support

3.2.3. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	CC	Type 1 (client to server)

3.2.4. Cluster Identifiers

Identifier	Name
0x0300	Color Control

3.2.5. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description
0	HS	Hue/Saturation	Supports color specification via hue/saturation.
1	EHUE	Enhanced Hue	Enhanced hue is supported.
2	CL	Color loop	Color loop is supported.
3	XY	XY	Supports color specification via XY.

Bit	Code	Feature	Description
4	CT	Color temperature	Supports specification of color temperature.

Support for EHUE SHALL require support for HS.

Support for CL SHALL require support for EHUE.

3.2.6. Dependencies

3.2.6.1. Coupling color temperature to Level Control

If the Level Control for Lighting cluster identifier 0x0008 is supported on the same endpoint as the Color Control cluster and color temperature is supported, it is possible to couple changes in the current level to the color temperature.

The CoupleColorTempToLevel bit of the Options attribute of the Level Control cluster indicates whether the color temperature is to be linked with the CurrentLevel attribute in the Level Control cluster.

If the CoupleColorTempToLevel bit of the Options attribute of the Level Control cluster is equal to 1 and the ColorMode or EnhancedColorMode attribute is set to 2 (color temperature) then a change in the CurrentLevel attribute SHALL affect the ColorTemperatureMireds attribute. This relationship is manufacturer specific, with the qualification that the maximum value of the CurrentLevel attribute SHALL correspond to a ColorTemperatureMired attribute value equal to the CoupleColorTempToLevelMinMireds attribute. This relationship is one-way so a change to the ColorTemperatureMireds attribute SHALL NOT have any effect on the CurrentLevel attribute.

In order to simulate the behavior of an incandescent bulb, a low value of the CurrentLevel attribute SHALL be associated with a high value of the ColorTemperatureMireds attribute (i.e., a low value of color temperature in kelvins).

If the CoupleColorTempToLevel bit of the Options attribute of the Level Control cluster is equal to 0, there SHALL be no link between color temperature and current level.

3.2.7. Color Information Attribute Set

The attributes defined in this cluster specification are arranged into four sets of related attributes.

The Color Information attribute set contains the attributes summarized below.

Table 37. Attributes of the Color Information Attribute Set

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x0000	CurrentHue	uint8	0 to 254	PN	0	R V	HS
0x0001	CurrentSaturation	uint8	0 to 254	PSN	0	R V	HS

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x0002	RemainingTime	uint16	0 to 65534		0	R V	O
0x0003	CurrentX	uint16	0 to 0xfffe	PSN	0x616b (0.381)	R V	XY
0x0004	CurrentY	uint16	0 to 0xfffe	PSN	0x607d (0.377)	R V	XY
0x0005	DriftCompensation	enum8	0 to 4		-	R V	O
0x0006	CompensationText	string	max 254		-	R V	O
0x0007	ColorTempera- tureMireds	uint16	0 to 0xfffe	PSN	0x00fa (4000K)	R V	CT
0x0008	ColorMode	enum8	0 to 2	N	1	R V	M
0x000f	Options	map8	desc		0	RW VO	M
0x4000	EnhancedCurrentHue	uint16	all	SN	0	R V	EHUE
0x4001	EnhancedColorMode	enum8	0 to 3	N	1	R V	M
0x4002	ColorLoopActive	uint8	all	SN	0	R V	CL
0x4003	ColorLoopDirection	uint8	all	SN	0	R V	CL
0x4004	ColorLoopTime	uint16	all	SN	0x0019	R V	CL
0x4005	ColorLoopStartEn- hancedHue	uint16	all		0x2300	R V	CL
0x4006	ColorLoopStoredEn- hancedHue	uint16	all		0	R V	CL
0x400a	ColorCapabilities	map16	0 to 0x001f		0	R V	M
0x400b	ColorTempPhysicalMin- Mireds	uint16	0 to 0xfffe		0	R V	CT
0x400c	ColorTempPhysical- MaxMireds	uint16	0 to 0xfffe		0xfffe	R V	CT
0x400d	CoupleColorTemp- ToLevelMinMireds	uint16	ColorTempPhysicalMin- Mireds to ColorTempera- tureMireds	MS	R V	CT Col- orTem- pera- tureMi reds	

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x4010	StartUpColorTempera- tureMireds	uint16	0 to 0xffff	X	MS	RW VM	CT Col- orTem- pera- tureMi- reds

Regarding attributes whose values persistent across an OTA restart (designated by 'N' in the Access column in the table above), only those attributes that are supported (due to the color capabilities of the device) need to be stored.

If the Scenes server cluster is implemented on the same endpoint, the following extension fields SHALL be added to the Scene Table in the given order, i.e., the attribute listed as 1 is added first:

1. CurrentX
2. CurrentY
3. EnhancedCurrentHue
4. CurrentSaturation
5. ColorLoopActive
6. ColorLoopDirection
7. ColorLoopTime
8. ColorTemperatureMireds

Since there is a direct relation between ColorTemperatureMireds and XY, color temperature, if supported, is stored as XY in the scenes table.

Attributes in the scene table that are not supported by the device (according to the FeatureMap attribute) SHALL be present in the scene table but ignored.

3.2.7.1. CurrentHue Attribute

The CurrentHue attribute contains the current hue value of the light. It is updated as fast as practical during commands that change the hue.

The hue in degrees SHALL be related to the CurrentHue attribute by the relationship:

$$\text{Hue} = \text{CurrentHue} \times 360 / 254 \quad (\text{CurrentHue in the range 0 to 254 inclusive})$$

If this attribute is implemented then the CurrentSaturation and ColorMode attributes SHALL also be implemented.

3.2.7.2. CurrentSaturation Attribute

The CurrentSaturation attribute holds the current saturation value of the light. It is updated as fast as practical during commands that change the saturation.

The saturation SHALL be related to the CurrentSaturation attribute by the relationship:

$Saturation = \text{CurrentSaturation}/254$ (CurrentSaturation in the range 0 to 254 inclusive)

If this attribute is implemented then the CurrentHue and ColorMode attributes SHALL also be implemented.

3.2.7.3. RemainingTime Attribute

The RemainingTime attribute holds the time remaining, in 1/10ths of a second, until the currently active command will be complete.

3.2.7.4. CurrentX Attribute

The CurrentX attribute contains the current value of the normalized chromaticity value x, as defined in the CIE xyY Color Space. It is updated as fast as practical during commands that change the color.

The value of x SHALL be related to the CurrentX attribute by the relationship

$x = \text{CurrentX} / 65536$ (CurrentX in the range 0 to 65279 inclusive)

3.2.7.5. CurrentY Attribute

The CurrentY attribute contains the current value of the normalized chromaticity value y, as defined in the CIE xyY Color Space. It is updated as fast as practical during commands that change the color.

The value of y SHALL be related to the CurrentY attribute by the relationship

$y = \text{CurrentY} / 65536$ (CurrentY in the range 0 to 65279 inclusive)

3.2.7.6. DriftCompensation Attribute

The DriftCompensation attribute indicates what mechanism, if any, is in use for compensation for color/intensity drift over time. It SHALL be one of the non-reserved values in [Values of the DriftCompensation Attribute](#).

Table 38. Values of the DriftCompensation Attribute

Value	Description
0	None
1	Other / Unknown
2	Temperature monitoring
3	Optical luminance monitoring and feedback
4	Optical color monitoring and feedback

3.2.7.7. CompensationText Attribute

The CompensationText attribute holds a textual indication of what mechanism, if any, is in use to

compensate for color/intensity drift over time.

3.2.7.8. ColorTemperatureMireds Attribute

The ColorTemperatureMireds attribute contains a scaled inverse of the current value of the color temperature. The unit of ColorTemperatureMireds is the mired (micro reciprocal degree), AKA mirek (micro reciprocal kelvin). It is updated as fast as practical during commands that change the color.

The color temperature value in kelvins SHALL be related to the ColorTemperatureMireds attribute in mireds by the relationship

Color temperature in kelvins = $1,000,000 / \text{ColorTemperatureMireds}$, where ColorTemperatureMireds is in the range 1 to 65279 mireds inclusive, giving a color temperature range from 1,000,000 kelvins to 15.32 kelvins.

If this attribute is implemented then the ColorMode attribute SHALL also be implemented.

3.2.7.9. ColorMode Attribute

The ColorMode attribute indicates which attributes are currently determining the color of the device.

The value of the ColorMode attribute cannot be written directly - it is set upon reception of any command in section [Commands](#) to the appropriate mode for that command.

Table 39. Values of the ColorMode Attribute

Value	Attributes that Determine the Color
0	CurrentHue and CurrentSaturation
1	CurrentX and CurrentY
2	ColorTemperatureMireds

3.2.7.10. Options Attribute

The Options attribute is meant to be changed only during commissioning. The Options attribute is a bitmap that determines the default behavior of some cluster commands. Each command that is dependent on the Options attribute SHALL first construct a temporary Options bitmap that is in effect during the command processing. The temporary Options bitmap has the same format and meaning as the Options attribute, but includes any bits that may be overridden by command fields.

Below is the format and description of the Options attribute and temporary Options bitmap and the effect on dependent commands.

Table 40. Options Attribute

Bit	Name	Values & Summary
0	ExecuteIfOff	0 – Do not execute command if the On/Off cluster, OnOff attribute is FALSE. 1 – Execute command if the On/Off cluster, OnOff attribute is FALSE.

ExecuteIfOff Options bit: Command execution SHALL NOT continue beyond the Options processing if all of these criteria are true:

- The On/Off cluster exists on the same endpoint as this cluster.
- The OnOff attribute of the On/Off cluster, on this endpoint, is FALSE.
- The value of the ExecuteIfOff bit is 0.

3.2.7.11. EnhancedCurrentHue Attribute

The EnhancedCurrentHue attribute represents non-equidistant steps along the CIE 1931 color triangle, and it provides 16-bits precision.

The upper 8 bits of this attribute SHALL be used as an index in the implementation specific XY lookup table to provide the non-equidistance steps. The lower 8 bits SHALL be used to interpolate between these steps in a linear way in order to provide color zoom for the user.

To provide compatibility with standard ZCL, the CurrentHue attribute SHALL contain a hue value in the range 0 to 254, calculated from the EnhancedCurrentHue attribute.

3.2.7.12. EnhancedColorMode Attribute

The EnhancedColorMode attribute specifies which attributes are currently determining the color of the device, as detailed in [Values of the EnhancedColorMode Attribute](#).

Table 41. Values of the EnhancedColorMode Attribute

Value	Attributes That Determine the Color
0	CurrentHue and CurrentSaturation
1	CurrentX and CurrentY
2	ColorTemperatureMireds
3	EnhancedCurrentHue and CurrentSaturation

To provide compatibility with standard ZCL, the original ColorMode attribute SHALL indicate ‘CurrentHue and CurrentSaturation’ when the light uses the EnhancedCurrentHue attribute. If the ColorMode attribute is changed, e.g., due to one of the standard Color Control cluster commands defined in the ZCL, its new value SHALL be copied to the EnhancedColorMode attribute.

3.2.7.13. ColorLoopActive Attribute

The ColorLoopActive attribute specifies the current active status of the color loop. If this attribute

has the value 0, the color loop SHALL not be active. If this attribute has the value 1, the color loop SHALL be active. All other values (2 to 254) are reserved.

3.2.7.14. ColorLoopDirection Attribute

The ColorLoopDirection attribute specifies the current direction of the color loop. If this attribute has the value 0, the EnhancedCurrentHue attribute SHALL be decremented. If this attribute has the value 1, the EnhancedCurrentHue attribute SHALL be incremented. All other values (2 to 254) are reserved.

3.2.7.15. ColorLoopTime Attribute

The ColorLoopTime attribute specifies the number of seconds it SHALL take to perform a full color loop, i.e., to cycle all values of the EnhancedCurrentHue attribute (between 0 and 0xffff).

3.2.7.16. ColorLoopStartEnhancedHue Attribute

The ColorLoopStartEnhancedHue attribute specifies the value of the EnhancedCurrentHue attribute from which the color loop SHALL be started.

3.2.7.17. ColorLoopStoredEnhancedHue Attribute

The ColorLoopStoredEnhancedHue attribute specifies the value of the EnhancedCurrentHue attribute before the color loop was started. Once the color loop is complete, the EnhancedCurrentHue attribute SHALL be restored to this value.

3.2.7.18. ColorCapabilities Attribute

Bits 0-4 of the ColorCapabilities attribute SHALL have the same values as the corresponding bits of the FeatureMap attribute. All other bits in ColorCapabilities SHALL be 0.

3.2.7.19. ColorTempPhysicalMinMireds Attribute

The ColorTempPhysicalMinMireds attribute indicates the minimum mired value supported by the hardware. ColorTempPhysicalMinMireds corresponds to the maximum color temperature in kelvins supported by the hardware. $\text{ColorTempPhysicalMinMireds} \leq \text{ColorTemperatureMireds}$.

3.2.7.20. ColorTempPhysicalMaxMireds Attribute

The ColorTempPhysicalMaxMireds attribute indicates the maximum mired value supported by the hardware. ColorTempPhysicalMaxMireds corresponds to the minimum color temperature in kelvins supported by the hardware. $\text{ColorTemperatureMireds} \leq \text{ColorTempPhysicalMaxMireds}$.

3.2.7.21. CoupleColorTempToLevelMinMireds Attribute

The CoupleColorTempToLevelMinMireds attribute specifies a lower bound on the value of the ColorTemperatureMireds attribute for the purposes of coupling the ColorTemperatureMireds attribute to the CurrentLevel attribute when the CoupleColorTempToLevel bit of the Options attribute of the Level Control cluster is equal to 1. When coupling the ColorTemperatureMireds attribute to the CurrentLevel attribute, this value SHALL correspond to a CurrentLevel value of 0xfe (100%).

This attribute SHALL be set such that the following relationship exists:

$\text{ColorTempPhysicalMinMireds} \leq \text{CoupleColorTempToLevelMinMireds} \leq \text{ColorTemperatureMireds}$

Note that since this attribute is stored as a micro reciprocal degree (mired) value (i.e. color temperature in kelvins = $1,000,000 / \text{CoupleColorTempToLevelMinMireds}$), the `CoupleColorTempToLevelMinMireds` attribute corresponds to an upper bound on the value of the color temperature in kelvins supported by the device.

3.2.7.22. StartUpColorTemperatureMireds Attribute

The `StartUpColorTemperatureMireds` attribute SHALL define the desired startup color temperature value a lamp SHALL use when it is supplied with power and this value SHALL be reflected in the `ColorTemperatureMireds` attribute. In addition, the `ColorMode` and `EnhancedColorMode` attributes SHALL be set to `0x02` (color temperature). The values of the `StartUpColorTemperatureMireds` attribute are listed in the table below,

Table 42. Values of the StartUpColorTemperatureMireds attribute

Value	Action on power up
0 to <code>0xffeff</code>	Set the <code>ColorTemperatureMireds</code> attribute to this value.
null	Set the <code>ColorTemperatureMireds</code> attribute to its previous value.

3.2.8. Defined Primaries Information Attribute Set

The Defined Primaries Information attribute set contains the attributes summarized in [Defined Primaries Information Attribute Set](#).

Table 43. Defined Primaries Information Attribute Set

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x0010	NumberOfPrimaries	uint8	0 to 6	FX	-	R V	M
0x0011	Primary1X	uint16	0 to <code>0xffeff</code>	F	-	R V	M^0
0x0012	Primary1Y	uint16	0 to <code>0xffeff</code>	F	-	R V	M^0
0x0013	Primary1Intensity	uint8	all	FX	-	R V	M^0
0x0015	Primary2X	uint16	0 to <code>0xffeff</code>	F	-	R V	M^1
0x0016	Primary2Y	uint16	0 to <code>0xffeff</code>	F	-	R V	M^1
0x0017	Primary2Intensity	uint8	all	FX	-	R V	M^1
0x0019	Primary3X	uint16	0 to <code>0xffeff</code>	F	-	R V	M^2
0x001a	Primary3Y	uint16	0 to <code>0xffeff</code>	F	-	R V	M^2
0x001b	Primary3Intensity	uint8	all	FX	-	R V	M^2

M^i = Mandatory if the value of the `NumberOfPrimaries` attribute is greater than i , otherwise optional.

3.2.8.1. NumberOfPrimaries Attribute

The NumberOfPrimaries attribute contains the number of color primaries implemented on this device. A value of null SHALL indicate that the number of primaries is unknown.

Where this attribute is implemented, the attributes below for indicating the “x” and “y” color values of the primaries SHALL also be implemented for each of the primaries from 1 to NumberOfPrimaries, without leaving gaps. Implementation of the Primary1Intensity attribute and subsequent intensity attributes is optional.

3.2.8.2. Primary1X Attribute

The Primary1X attribute contains the normalized chromaticity value x for this primary, as defined in the CIE xyY Color Space.

The value of x SHALL be related to the Primary1X attribute by the relationship

$$x = \text{Primary1X} / 65536 \text{ (Primary1X in the range 0 to 65279 inclusive)}$$

3.2.8.3. Primary1Y Attribute

The Primary1Y attribute contains the normalized chromaticity value y for this primary, as defined in the CIE xyY Color Space.

The value of y SHALL be related to the Primary1Y attribute by the relationship

$$y = \text{Primary1Y} / 65536 \text{ (Primary1Y in the range 0 to 65279 inclusive)}$$

3.2.8.4. Primary1Intensity Attribute

The Primary1Intensity attribute contains a representation of the maximum intensity of this primary as defined in the Dimming Light Curve in the Ballast Configuration cluster (see [Ballast Configuration Cluster](#)), normalized such that the primary with the highest maximum intensity contains the value 0xfe.

A value of null SHALL indicate that this primary is not available.

3.2.8.5. Remaining Attributes

The Primary2X, Primary2Y, Primary2Intensity, Primary3X, Primary3Y and Primary3Intensity attributes are used to represent the capabilities of the 2nd and 3rd primaries, where present, in the same way as for the Primary1X, Primary1Y and Primary1Intensity attributes.

3.2.9. Additional Defined Primaries Information Attribute Set

The Additional Defined Primaries Information attribute set contains the attributes summarized in [Additional Defined Primaries Information Attribute Set](#).

Table 44. Additional Defined Primaries Information Attribute Set

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x0020	Primary4X	uint16	0 to 0xfeff	F	-	R V	M ³
0x0021	Primary4Y	uint16	0 to 0xfeff	F	-	R V	M ³
0x0022	Primary4Intensity	uint8	all	FX	-	R V	M ³
0x0024	Primary5X	uint16	0 to 0xfeff	F	-	R V	M ⁴
0x0025	Primary5Y	uint16	0 to 0xfeff	F	-	R V	M ⁴
0x0026	Primary5Intensity	uint8	all	FX	-	R V	M ⁴
0x0028	Primary6X	uint16	0 to 0xfeff	F	-	R V	M ⁵
0x0029	Primary6Y	uint16	0 to 0xfeff	F	-	R V	M ⁵
0x002a	Primary6Intensity	uint8	all	FX	-	R V	M ⁵

Mⁱ = Mandatory if the value of the NumberOfPrimaries attribute is greater than *i*, otherwise optional.

3.2.9.1. Remaining Attributes

The Primary4X, Primary4Y, Primary4Intensity, Primary5X, Primary5Y, Primary5Intensity, Primary6X, Primary6Y and Primary6Intensity attributes represent the capabilities of the 4th, 5th and 6th primaries, where present, in the same way as the Primary1X, Primary1Y and Primary1Intensity attributes.

3.2.10. Defined Color Points Settings Attribute Set

The Defined Color Points Settings attribute set contains the attributes summarized in [Defined Color Points Settings Attribute Set](#).

Table 45. Defined Color Points Settings Attribute Set

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x0030	WhitePointX	uint16	0 to 0xfeff	-	RW VM	O	
0x0031	WhitePointY	uint16	0 to 0xfeff	-	RW VM	O	
0x0032	ColorPointRX	uint16	0 to 0xfeff	-	RW VM	O	
0x0033	ColorPointRY	uint16	0 to 0xfeff	-	RW VM	O	
0x0034	ColorPointRIntensity	uint8	all	X	-	RW VM	O

ID	Name	Type	Constraint	Qual- ity	Defaul t	Access	Con- for- mance
0x0036	ColorPointGX	uint16	0 to 0xfffe		-	RW VM	O
0x0037	ColorPointGY	uint16	0 to 0xfffe		-	RW VM	O
0x0038	ColorPointGIntensity	uint8	all	X	-	RW VM	O
0x003a	ColorPointBX	uint16	0 to 0xfffe		-	RW VM	O
0x003b	ColorPointBY	uint16	0 to 0xfffe		-	RW VM	O
0x003c	ColorPointBIntensity	uint8	all	X	-	RW VM	O

3.2.10.1. WhitePointX Attribute

The WhitePointX attribute contains the normalized chromaticity value x, as defined in the CIE xyY Color Space, of the current white point of the device.

The value of x SHALL be related to the WhitePointX attribute by the relationship

$$x = \text{WhitePointX} / 65536 \text{ (WhitePointX in the range 0 to 65279 inclusive)}$$

3.2.10.2. WhitePointY Attribute

The WhitePointY attribute contains the normalized chromaticity value y, as defined in the CIE xyY Color Space, of the current white point of the device.

The value of y SHALL be related to the WhitePointY attribute by the relationship

$$y = \text{WhitePointY} / 65536 \text{ (WhitePointY in the range 0 to 65279 inclusive)}$$

3.2.10.3. ColorPointRX Attribute

The ColorPointRX attribute contains the normalized chromaticity value x, as defined in the CIE xyY Color Space, of the red color point of the device.

The value of x SHALL be related to the ColorPointRX attribute by the relationship

$$x = \text{ColorPointRX} / 65536 \text{ (ColorPointRX in the range 0 to 65279 inclusive)}$$

3.2.10.4. ColorPointRY Attribute

The ColorPointRY attribute contains the normalized chromaticity value y, as defined in the CIE xyY Color Space, of the red color point of the device.

The value of y SHALL be related to the ColorPointRY attribute by the relationship

$$y = \text{ColorPointRY} / 65536 \text{ (ColorPointRY in the range 0 to 65279 inclusive)}$$

3.2.10.5. ColorPointRIntensity Attribute

The ColorPointRIntensity attribute contains a representation of the relative intensity of the red color point as defined in the Dimming Light Curve in the Ballast Configuration cluster (see [Ballast Configuration Cluster](#)), normalized such that the color point with the highest relative intensity contains the value 0xfe.

A value of null SHALL indicate an invalid value.

3.2.10.6. Remaining Attributes

The ColorPointGX, ColorPointGY, ColorPointGIntensity, ColorPointBX, ColorPointBY and, ColorPointBIntensity attributes are used to represent the chromaticity values and intensities of the green and blue color points, in the same way as for the ColorPointRX, ColorPointRY and ColorPointRIntensity attributes.

If any one of these red, green or blue color point attributes is implemented then they SHALL all be implemented.

3.2.11. Commands

The command IDs for the Color Control cluster are listed in [Command IDs for the Color Control Cluster](#).

Table 46. Command IDs for the Color Control Cluster

ID	Name	Direction	Response	Access	Conformance
0x00	MoveToHue	client ⇒ server	Y	O	HS
0x01	MoveHue	client ⇒ server	Y	O	HS
0x02	StepHue	client ⇒ server	Y	O	HS
0x03	MoveToSaturation	client ⇒ server	Y	O	HS
0x04	MoveSaturation	client ⇒ server	Y	O	HS
0x05	StepSaturation	client ⇒ server	Y	O	HS
0x06	MoveToHueAndSaturation	client ⇒ server	Y	O	HS
0x07	MoveToColor	client ⇒ server	Y	O	XY
0x08	MoveColor	client ⇒ server	Y	O	XY
0x09	StepColor	client ⇒ server	Y	O	XY
0xa0	MoveToColorTemperature	client ⇒ server	Y	O	CT

ID	Name	Direction	Response	Access	Conformance
0x40	EnhancedMoveToHue	client ⇒ server	Y	O	EHUE
0x41	EnhancedMoveHue	client ⇒ server	Y	O	EHUE
0x42	EnhancedStepHue	client ⇒ server	Y	O	EHUE
0x43	EnhancedMoveToHue-AndSaturation	client ⇒ server	Y	O	EHUE
0x44	ColorLoopSet	client ⇒ server	Y	O	CL
0x47	StopMoveStep	client ⇒ server	Y	O	HS XY CT
0x4b	MoveColorTemperature	client ⇒ server	Y	O	CT
0x4c	StepColorTemperature	client ⇒ server	Y	O	CT

3.2.11.1. Generic Usage Notes

When asked to change color via one of these commands, the implementation SHALL select a color, within the limits of the hardware of the device, which is as close as possible to that requested. The determination as to the true representations of color is out of the scope of this specification. However, as long as the color data fields of the received command are within the permitted range of this specification and no error condition applies, the resulting status code SHALL be SUCCESS.

For example the MoveToColorTemperature command: if the target color temperature is not achievable by the hardware then the color temperature SHALL be clipped at the physical minimum or maximum achievable (depending on the direction of the color temperature transition) when the device reaches that color temperature (which MAY be before the requested transition time).

If a color loop is active (i.e., the ColorLoopActive attribute is equal to 1), it SHALL only be stopped by sending a specific ColorLoopSet command frame with a request to deactivate the color loop (i.e., the color loop SHALL not be stopped on receipt of another command such as the EnhancedMoveToHue command). In addition, while a color loop is active, a manufacturer MAY choose to ignore incoming color commands which affect a change in hue.

3.2.11.2. Note on Change of ColorMode

The first action taken when any one of these commands is received is to change the ColorMode attribute to the appropriate value for the command (see individual commands). Note that, when moving from one color mode to another (e.g., CurrentX/CurrentY to CurrentHue/CurrentSaturation), the starting color for the command is formed by calculating the values of the new attributes (in this case CurrentHue, CurrentSaturation) from those of the old attributes (in this case CurrentX and CurrentY).

When moving from a mode to another mode that has a more restricted color range (e.g., CurrentX/CurrentY to CurrentHue/CurrentSaturation, or CurrentHue/CurrentSaturation to ColorTemperatureMireds) it is possible for the current color value to have no equivalent in the new mode. The behavior in such cases is manufacturer dependent, and therefore it is recommended to avoid

color mode changes of this kind during usage.

3.2.11.3. Use of the OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL both be present. Default values are provided to interpret missing fields from legacy devices. A temporary Options bitmap SHALL be created from the Options attribute, using the OptionsMask and OptionsOverride fields. Each bit of the temporary Options bitmap SHALL be determined as follows:

Each bit in the Options attribute SHALL determine the corresponding bit in the temporary Options bitmap, unless the OptionsMask field is present and has the corresponding bit set to 1, in which case the corresponding bit in the OptionsOverride field SHALL determine the corresponding bit in the temporary Options bitmap.

The resulting temporary Options bitmap SHALL then be processed as defined in section [Options Attribute](#).

3.2.11.4. MoveToHue Command

The MoveToHue command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Hue	uint8	0 to 254			M
1	Direction	enum8	desc			M
2	TransitionTime	uint16	0 to 65534			M
3	OptionsMask	map8	desc		0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.4.1. Hue Field

The Hue field specifies the hue to be moved to.

3.2.11.4.2. Direction Field

The Direction field SHALL be one of the non-reserved values in [Values of the Direction Field](#).

Table 47. Values of the Direction Field

Value	Description
0	Shortest distance
1	Longest distance
2	Up
3	Down

3.2.11.4.3. TransitionTime Field

The TransitionTime field specifies, in 1/10ths of a second, the time that SHALL be taken to move to the new hue.

3.2.11.4.4. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.4.5. Effect on Receipt

On receipt of this command, a device SHALL also set the ColorMode attribute to the value 0 and then SHALL move from its current hue to the value given in the Hue field.

The movement SHALL be continuous, i.e., not a step function, and the time taken to move to the new hue SHALL be equal to the TransitionTime field.

As hue is effectively measured on a circle, the new hue MAY be moved to in either direction. The direction of hue change is given by the Direction field. If Direction is 'Shortest distance', the direction is taken that involves the shortest path round the circle. This case corresponds to expected normal usage. If Direction is 'Longest distance', the direction is taken that involves the longest path round the circle. This case can be used for 'rainbow effects'. In both cases, if both distances are the same, the Up direction SHALL be taken.

3.2.11.5. MoveHue Command

The MoveHue command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	MoveMode	enum8	desc			M
1	Rate	uint8	all			M
2	OptionsMask	map8	desc		0	M
3	OptionsOverride	map8	desc		0	M

3.2.11.5.1. MoveMode Field

The MoveMode field SHALL be one of the non-reserved values in [Values of the MoveMode Field](#). If the MoveMode field is equal to 0 (Stop), the Rate field SHALL be ignored.

Table 48. Values of the MoveMode Field

Value	Description
0	Stop
1	Up
2	Reserved
3	Down

3.2.11.5.2. Rate Field

The Rate field specifies the rate of movement in steps per second. A step is a change in the device's hue of one unit. If the MoveMode field is set to 1 (up) or 3 (down) and the Rate field has a value of zero, the command has no effect and a response command SHALL be sent in response, with the status code set to INVALID_COMMAND. If the MoveMode field is set to 0 (stop) the Rate field SHALL be ignored.

3.2.11.5.3. OptionsMask and OptionsOverride field

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.5.4. Effect on Receipt

On receipt of this command, a device SHALL set the ColorMode attribute to the value 0 and SHALL then move from its current hue in an up or down direction in a continuous fashion, as detailed in [Actions on Receipt for MoveHue Command](#).

Table 49. Actions on Receipt for MoveHue Command

MoveMode	Action on Receipt
Stop	If moving, stop, else ignore the command (i.e., the command is accepted but has no effect). NB This MAY also be used to stop a MoveToHue command, a MoveToSaturation command, or a MoveToHueAndSaturation command.
Up	Increase the device's hue at the rate given in the Rate field. If the hue reaches the maximum allowed for the device, then wraparound and proceed from its minimum allowed value.
Down	Decrease the device's hue at the rate given in the Rate field. If the hue reaches the minimum allowed for the device, then wraparound and proceed from its maximum allowed value.

3.2.11.6. StepHue Command

The StepHue command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	StepMode	enum8	desc			M
1	StepSize	uint8	all			M
2	TransitionTime	uint8	all			M
3	OptionsMask	map8	desc	0	0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.6.1. StepMode Field

The StepMode field SHALL be one of the non-reserved values in [Values of the StepMode Field](#).

Table 50. Values of the StepMode Field

Value	Description
0	Reserved
1	Up
2	Reserved
3	Down

3.2.11.6.2. StepSize Field

The change to be added to (or subtracted from) the current value of the device's hue.

3.2.11.6.3. TransitionTime Field

The TransitionTime field specifies, in 1/10ths of a second, the time that SHALL be taken to perform the step. A step is a change in the device's hue of 'Step size' units.

Note: Here the TransitionTime data field is of data type uint8, where uint16 is more common for TransitionTime data fields in other clusters / commands.

3.2.11.6.4. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.6.5. Effect on Receipt

On receipt of this command, a device SHALL set the ColorMode attribute to the value 0 and SHALL then move from its current hue in an up or down direction by one step, as detailed in [Actions on Receipt for StepHue Command](#).

Table 51. Actions on Receipt for StepHue Command

StepMode	Action on Receipt
Up	Increase the device's hue by one step, in a continuous fashion. If the hue value reaches the maximum value then wraparound and proceed from the minimum allowed value.
Down	Decrease the device's hue by one step, in a continuous fashion. If the hue value reaches the minimum value then wraparound and proceed from the maximum allowed value.

3.2.11.7. MoveToSaturation Command

The MoveToSaturation command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Saturation	uint8	0 to 254			M

ID	Name	Type	Constraint	Quality	Default	Conformance
1	TransitionTime	uint16	0 to 65534			M
2	OptionsMask	map8	desc		0	M
3	OptionsOverride	map8	desc		0	M

3.2.11.7.1. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.7.2. Effect on Receipt

On receipt of this command, a device set the ColorMode attribute to the value 0 and SHALL then move from its current saturation to the value given in the Saturation field.

The movement SHALL be continuous, i.e., not a step function, and the time taken to move to the new saturation SHALL be equal to the TransitionTime field, in 1/10ths of a second.

3.2.11.8. MoveSaturation Command

The MoveSaturation command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	MoveMode	enum8	desc			M
1	Rate	uint8	all			M
2	OptionsMask	map8	desc		0	M
3	OptionsOverride	map8	desc		0	M

3.2.11.8.1. MoveMode Field

The MoveMode field SHALL be one of the non-reserved values in [Values of the MoveMode Field](#). If the MoveMode field is equal to 0 (Stop), the Rate field SHALL be ignored.

Table 52. Values of the MoveMode Field

Value	Description
0	Stop
1	Up
2	Reserved
3	Down

3.2.11.8.2. Rate Field

The Rate field specifies the rate of movement in steps per second. A step is a change in the device's

saturation of one unit. If the MoveMode field is set to 1 (up) or 3 (down) and the Rate field has a value of zero, the command has no effect and a response command SHALL be sent in response, with the status code set to INVALID_COMMAND. If the MoveMode field is set to 0 (stop) the Rate field SHALL be ignored.

3.2.11.8.3. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.8.4. Effect on Receipt

On receipt of this command, a device SHALL set the ColorMode attribute to the value 0 and SHALL then move from its current saturation in an up or down direction in a continuous fashion, as detailed in [Actions on Receipt for MoveSaturation Command](#).

Table 53. Actions on Receipt for MoveSaturation Command

MoveMode	Action on Receipt
Stop	If moving, stop, else ignore the command (i.e., the command is accepted but has no effect). NB This MAY also be used to stop a MoveToSaturation command, a MoveToHue command, or a MoveToHueAndSaturation command.
Up	Increase the device's saturation at the rate given in the Rate field. If the saturation reaches the maximum allowed for the device, stop.
Down	Decrease the device's saturation at the rate given in the Rate field. If the saturation reaches the minimum allowed for the device, stop.

3.2.11.9. StepSaturation Command

The StepSaturation command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	StepMode	enum8	desc			M
1	StepSize	uint8	all			M
2	TransitionTime	uint8	all			M
3	OptionsMask	map8	desc		0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.9.1. StepMode Field

The StepMode field SHALL be one of the non-reserved values in [Values of the StepMode Field](#).

Table 54. Values of the StepMode Field

Value	Description
1	Up

Value	Description
2	Reserved
3	Down

3.2.11.9.2. StepSize Field

The change to be added to (or subtracted from) the current value of the device's saturation.

3.2.11.9.3. TransitionTime Field

The TransitionTime field specifies, in 1/10ths of a second, the time that SHALL be taken to perform the step. A step is a change in the device's saturation of 'Step size' units.

Note: Here the TransitionTime data field is of data type uint8, where uint16 is more common for TransitionTime data fields in other clusters / commands.

3.2.11.9.4. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.9.5. Effect on Receipt

On receipt of this command, a device SHALL set the ColorMode attribute to the value 0 and SHALL then move from its current saturation in an up or down direction by one step, as detailed in [Actions on Receipt for StepSaturation Command](#).

Table 55. Actions on Receipt for StepSaturation Command

StepMode	Action on Receipt
Up	Increase the device's saturation by one step, in a continuous fashion. However, if the saturation value is already the maximum value then do nothing.
Down	Decrease the device's saturation by one step, in a continuous fashion. However, if the saturation value is already the minimum value then do nothing.

3.2.11.10. MoveToHueAndSaturation Command

The MoveToHueAndSaturation command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Hue	uint8	0 to 254			M
1	Saturation	uint8	0 to 254			M
2	TransitionTime	uint16	0 to 65534			M
3	OptionsMask	map8	desc		0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.10.1. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.10.2. Effect on Receipt

On receipt of this command, a device SHALL set the ColorMode attribute to the value 0 and SHALL then move from its current hue and saturation to the values given in the Hue and Saturation fields.

The movement SHALL be continuous, i.e., not a step function, and the time taken to move to the new color SHALL be equal to the TransitionTime field, in 1/10ths of a second.

The path through color space taken during the transition is not specified, but it is recommended that the shortest path is taken through hue/saturation space, i.e., movement is 'in a straight line' across the hue/saturation disk.

3.2.11.11. MoveToColor Command

The MoveToColor command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	ColorX	uint16	0 to 0xffff			M
1	ColorY	uint16	0 to 0xffff			M
2	TransitionTime	uint16	0 to 65534			M
3	OptionsMask	map8	desc		0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.11.1. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.11.2. Effect on Receipt

On receipt of this command, a device SHALL set the value of the ColorMode attribute, where implemented, to 1, and SHALL then move from its current color to the color given in the ColorX and ColorY fields.

The movement SHALL be continuous, i.e., not a step function, and the time taken to move to the new color SHALL be equal to the TransitionTime field, in 1/10ths of a second.

The path through color space taken during the transition is not specified, but it is recommended that the shortest path is taken through color space, i.e., movement is 'in a straight line' across the CIE xyY Color Space.

3.2.11.12. MoveColor Command

The MoveColor command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	RateX	int16	all			M
1	RateY	int16	all			M
2	OptionsMask	map8	desc		0	M
3	OptionsOverride	map8	desc		0	M

3.2.11.12.1. RateX Field

The RateX field specifies the rate of movement in steps per second. A step is a change in the device's CurrentX attribute of one unit.

3.2.11.12.2. RateY Field

The RateY field specifies the rate of movement in steps per second. A step is a change in the device's CurrentY attribute of one unit.

3.2.11.12.3. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.12.4. Effect on Receipt

On receipt of this command, a device SHALL set the value of the ColorMode attribute, where implemented, to 1, and SHALL then move from its current color in a continuous fashion according to the rates specified. This movement SHALL continue until the target color for the next step cannot be implemented on this device.

If both the RateX and RateY fields contain a value of zero, no movement SHALL be carried out, and the command execution SHALL have no effect other than stopping the operation of any previously received command of this cluster. This command can thus be used to stop the operation of any other command of this cluster.

3.2.11.13. StepColor Command

The StepColor command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	StepX	int16	all			M
1	StepY	int16	all			M
2	TransitionTime	uint16	0 to 65534			M

ID	Name	Type	Constraint	Quality	Default	Conformance
3	OptionsMask	map8	desc		0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.13.1. StepX and StepY Fields

The StepX and StepY fields specify the change to be added to the device's CurrentX attribute and CurrentY attribute respectively.

3.2.11.13.2. TransitionTime Field

The TransitionTime field specifies, in 1/10ths of a second, the time that SHALL be taken to perform the color change.

3.2.11.13.3. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.13.4. Effect on Receipt

On receipt of this command, a device SHALL set the value of the ColorMode attribute, where implemented, to 1, and SHALL then move from its current color by the color step indicated.

The movement SHALL be continuous, i.e., not a step function, and the time taken to move to the new color SHALL be equal to the TransitionTime field, in 1/10ths of a second.

The path through color space taken during the transition is not specified, but it is recommended that the shortest path is taken through color space, i.e., movement is 'in a straight line' across the CIE xyY Color Space.

Note also that if the required step is larger than can be represented by signed 16-bit integers then more than one step command SHOULD be issued.

3.2.11.14. MoveToColorTemperature Command

The MoveToColorTemperature command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	ColorTemperatureMireds	uint16	0 to 0xffff			M
1	TransitionTime	uint16	0 to 65534			M
2	OptionsMask	map8	desc		0	M
3	OptionsOverride	map8	desc		0	M

3.2.11.14.1. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.14.2. Effect on Receipt

On receipt of this command, a device SHALL set the value of the ColorMode attribute, where implemented, to 2, and SHALL then move from its current color to the color given by the ColorTemperatureMireds field.

The movement SHALL be continuous, i.e., not a step function, and the time taken to move to the new color SHALL be equal to the TransitionTime field, in 1/10ths of a second.

By definition of this color mode, the path through color space taken during the transition is along the 'Black Body Line'.

3.2.11.15. EnhancedMoveToHue Command

The EnhancedMoveToHue command allows lamps to be moved in a smooth continuous transition from their current hue to a target hue.

The EnhancedMoveToHue command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	EnhancedHue	uint16	all			M
1	Direction	enum8	desc			M
2	TransitionTime	uint16	0 to 65534			M
3	OptionsMask	map8	desc	0	0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.15.1. EnhancedHue Field

The EnhancedHue field specifies the target extended hue for the lamp.

3.2.11.15.2. Direction Field

This field is identical to the Direction field of the MoveToHue command of the Color Control cluster (see sub-clause [Use of the OptionsMask and OptionsOverride fields](#)).

3.2.11.15.3. TransitionTime Field

This field is identical to the TransitionTime field of the MoveToHue command of the Color Control cluster (see sub-clause [Use of the OptionsMask and OptionsOverride fields](#)).

3.2.11.15.4. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.15.5. Effect on Receipt

On receipt of this command, a device SHALL set the ColorMode attribute to 0 and set the Enhanced-ColorMode attribute to the value 3. The device SHALL then move from its current enhanced hue to the value given in the EnhancedHue field.

The movement SHALL be continuous, i.e., not a step function, and the time taken to move to the new enhanced hue SHALL be equal to the TransitionTime field.

3.2.11.16. EnhancedMoveHue Command

The EnhancedMoveHue command allows lamps to be moved in a continuous stepped transition from their current hue to a target hue.

The EnhancedMoveHue command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	MoveMode	enum8	desc			M
1	Rate	uint16	all			M
2	OptionsMask	map8	desc		0	M
3	OptionsOverride	map8	desc		0	M

3.2.11.16.1. MoveMode Field

This field is identical to the MoveMode field of the MoveHue command of the Color Control cluster (see sub-clause [MoveHue Command](#)). If the MoveMode field is equal to 0 (Stop), the Rate field SHALL be ignored.

3.2.11.16.2. Rate field

The Rate field specifies the rate of movement in steps per second. A step is a change in the extended hue of a device by one unit. If the MoveMode field is set to 1 (up) or 3 (down) and the Rate field has a value of zero, the command has no effect and a response command SHALL be sent in response, with the status code set to INVALID_COMMAND. If the MoveMode field is set to 0 (stop) the Rate field SHALL be ignored.

3.2.11.16.3. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.16.4. Effect on receipt

On receipt of this command, a device SHALL set the ColorMode attribute to 0 and set the Enhanced-ColorMode attribute to the value 3. The device SHALL then move from its current enhanced hue in an up or down direction in a continuous fashion, as detailed in [Actions on Receipt of the Enhanced-MoveHueCommand](#).

Table 56. Actions on Receipt of the EnhancedMoveHueCommand

MoveMode	Action on Receipt
Stop	If moving, stop, else ignore the command (i.e., the command is accepted but has no effect). NB This MAY also be used to stop an EnhancedMoveToHue command or an EnhancedMoveToHueAndSaturation command.
Up	Increase the device's enhanced hue at the rate given in the Rate field. If the enhanced hue reaches the maximum allowed for the device, wraparound and proceed from its minimum allowed value.
Down	Decrease the device's enhanced hue at the rate given in the Rate field. If the hue reaches the minimum allowed for the device, wraparound and proceed from its maximum allowed value.

3.2.11.17. EnhancedStepHue Command

The EnhancedStepHue command allows lamps to be moved in a stepped transition from their current hue to a target hue, resulting in a linear transition through XY space.

The EnhancedStepHue command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	StepMode	enum8	desc			M
1	StepSize	uint16	all			M
2	TransitionTime	uint16	0 to 65534			M
3	OptionsMask	map8	desc	0	0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.17.1. StepMode Field

This field is identical to the StepMode field of the StepHue command of the Color Control cluster (see sub-clause [StepHue Command](#)).

3.2.11.17.2. StepSize Field

The StepSize field specifies the change to be added to (or subtracted from) the current value of the device's enhanced hue.

3.2.11.17.3. TransitionTime Field

The TransitionTime field specifies, in units of 1/10ths of a second, the time that SHALL be taken to perform the step. A step is a change to the device's enhanced hue of a magnitude corresponding to the StepSize field.

Note: Here TransitionTime data field is of data type uint16, while the TransitionTime data field of the StepHue command is of data type uint8.

3.2.11.17.4. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.17.5. Effect on Receipt

On receipt of this command, a device SHALL set the ColorMode attribute to 0 and the EnhancedColorMode attribute to the value 3. The device SHALL then move from its current enhanced hue in an up or down direction by one step, as detailed in [Actions on Receipt for the EnhancedStepHue Command](#).

Table 57. Actions on Receipt for the EnhancedStepHue Command

StepMode	Action on Receipt
Up	Increase the device's enhanced hue by one step. If the enhanced hue reaches the maximum allowed for the device, wraparound and proceed from its minimum allowed value.
Down	Decrease the device's enhanced hue by one step. If the hue reaches the minimum allowed for the device, wraparound and proceed from its maximum allowed value.

3.2.11.18. EnhancedMoveToHueAndSaturation Command

The EnhancedMoveToHueAndSaturation command allows lamps to be moved in a smooth continuous transition from their current hue to a target hue and from their current saturation to a target saturation.

The EnhancedMoveToHueAndSaturation command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	EnhancedHue	uint16	all			M
1	Saturation	uint8	0 to 254			M
2	TransitionTime	uint16	0 to 65534			M
3	OptionsMask	map8	desc		0	M
4	OptionsOverride	map8	desc		0	M

3.2.11.18.1. EnhancedHue Field

The EnhancedHue field specifies the target extended hue for the lamp.

3.2.11.18.2. Saturation Field

This field is identical to the Saturation field of the MoveToHueAndSaturation command of the Color Control cluster (see sub-clause [MoveToHueAndSaturation Command](#)).

3.2.11.18.3. TransitionTime Field

This field is identical to the TransitionTime field of the MoveToHue command of the Color Control cluster (see sub-clause [MoveToHueAndSaturation Command](#)).

3.2.11.18.4. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.18.5. Effect on Receipt

On receipt of this command, a device SHALL set the ColorMode attribute to the value 0 and set the EnhancedColorMode attribute to the value 3. The device SHALL then move from its current enhanced hue and saturation to the values given in the EnhancedHue and Saturation fields.

The movement SHALL be continuous, i.e., not a step function, and the time taken to move to the new color SHALL be equal to the TransitionTime field, in 1/10ths of a second.

The path through color space taken during the transition is not specified, but it is recommended that the shortest path is taken through hue/saturation space, i.e., movement is 'in a straight line' across the hue/saturation disk.

3.2.11.19. ColorLoopSet Command

The Color Loop Set command allows a color loop to be activated such that the color lamp cycles through its range of hues.

The ColorLoopSet command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	UpdateFlags	map8	desc			M
1	Action	enum8	desc			M
2	Direction	enum8	desc			M
3	Time	uint16	all			M
4	StartHue	uint16	all			M
5	OptionsMask	map8	desc	0		M
6	OptionsOverride	map8	desc	0		M

3.2.11.19.1. UpdateFlags Field

The UpdateFlags field specifies which color loop attributes to update before the color loop is started. This field SHALL be formatted as illustrated in [Format of the UpdateFlags Field of the ColorLoopSet Command](#).

Table 58. Format of the UpdateFlags Field of the ColorLoopSet Command

Bit	Name sub-field
0	UpdateAction
1	UpdateDirection
2	UpdateTime
3	UpdateStartHue
4-7	(Reserved)

The UpdateAction sub-field is 1 bit in length and specifies whether the device SHALL adhere to the action field in order to process the command. If this sub-field is set to 1, the device SHALL adhere to the action field. If this sub-field is set to 0, the device SHALL ignore the Action field.

The UpdateDirection sub-field is 1 bit in length and specifies whether the device SHALL update the ColorLoopDirection attribute with the Direction field. If this sub-field is set to 1, the device SHALL update the value of the ColorLoopDirection attribute with the value of the Direction field. If this sub-field is set to 0, the device SHALL ignore the Direction field.

The UpdateTime sub-field is 1 bit in length and specifies whether the device SHALL update the ColorLoopTime attribute with the Time field. If this sub-field is set to 1, the device SHALL update the value of the ColorLoopTime attribute with the value of the Time field. If this sub-field is set to 0, the device SHALL ignore the Time field.

The UpdateStartHue sub-field is 1 bit in length and specifies whether the device SHALL update the ColorLoopStartEnhancedHue attribute with the StartHue field. If this sub-field is set to 1, the device SHALL update the value of the ColorLoopStartEnhancedHue attribute with the value of the StartHue field. If this sub-field is set to 0, the device SHALL ignore the StartHue field.

3.2.11.19.2. Action Field

The Action field specifies the action to take for the color loop if the UpdateAction sub-field of the UpdateFlags field is set to 1. This field SHALL be set to one of the non-reserved values listed in [Values of the Action Field of the ColorLoopSet Command](#).

Table 59. Values of the Action Field of the ColorLoopSet Command

Value	Description
0	De-activate the color loop.
1	Activate the color loop from the value in the ColorLoopStartEnhancedHue field.
2	Activate the color loop from the value of the EnhancedCurrentHue attribute.

3.2.11.19.3. Direction Field

The Direction field specifies the direction for the color loop if the Update Direction field of the UpdateFlags field is set to 1. This field SHALL be set to one of the non-reserved values listed in [Values of the Direction Field of the ColorLoopSet Command](#).

Table 60. Values of the Direction Field of the ColorLoopSet Command

Value	Description
0	Decrement the hue in the color loop.
1	Increment the hue in the color loop.

3.2.11.19.4. Time Field

The Time field specifies the number of seconds over which to perform a full color loop if the UpdateTime sub-field of the UpdateFlags field is set to 1.

3.2.11.19.5. Start Hue Field

The StartHue field specifies the starting hue to use for the color loop if the Update StartHue field of the Update Flags field is set to 1.

3.2.11.19.6. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.19.7. Effect on Receipt

On receipt of this command, the device SHALL first update its color loop attributes according to the value of the UpdateFlags field, as follows. If the UpdateDirection sub-field is set to 1, the device SHALL set the ColorLoopDirection attribute to the value of the Direction field. If the UpdateTime sub-field is set to 1, the device SHALL set the ColorLoopTime attribute to the value of the Time field. If the UpdateStartHue sub-field is set to 1, the device SHALL set the ColorLoopStartEnhancedHue attribute to the value of the StartHue field. If the color loop is active (and stays active), the device SHALL immediately react on updates of the ColorLoopDirection and ColorLoopTime attributes.

If the UpdateAction sub-field of the UpdateFlags field is set to 1, the device SHALL adhere to the action specified in the Action field, as follows. If the value of the Action field is set to 0 and the color loop is active, i.e. the ColorLoopActive attribute is set to 1, the device SHALL de-active the color loop, set the ColorLoopActive attribute to 0 and set the EnhancedCurrentHue attribute to the value of the ColorLoopStoredEnhancedHue attribute. If the value of the Action field is set to 0 and the color loop is inactive, i.e. the ColorLoopActive attribute is set to 0, the device SHALL ignore the action update component of the command. If the value of the action field is set to 1, the device SHALL set the ColorLoopStoredEnhancedHue attribute to the value of the EnhancedCurrentHue attribute, set the ColorLoopActive attribute to 1 and activate the color loop, starting from the value of the ColorLoopStartEnhancedHue attribute. If the value of the Action field is set to 2, the device SHALL set the ColorLoopStoredEnhancedHue attribute to the value of the EnhancedCurrentHue attribute, set the ColorLoopActive attribute to 1 and activate the color loop, starting from the value of the EnhancedCurrentHue attribute.

If the color loop is active, the device SHALL cycle over the complete range of values of the EnhancedCurrentHue attribute in the direction of the ColorLoopDirection attribute over the time specified in the ColorLoopTime attribute. The level of increments/decrements is application specific.

3.2.11.20. StopMoveStep Command

The StopMoveStep command is provided to allow MoveTo and Step commands to be stopped. (Note this automatically provides symmetry to the Level Control cluster.)

Note: the StopMoveStep command has no effect on an active color loop.

The StopMoveStep command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	OptionsMask	map8	desc		0	M
1	OptionsOverride	map8	desc		0	M

3.2.11.20.1. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.20.2. Effect on Receipt

Upon receipt of this command, any MoveTo, Move or Step command currently in process SHALL be terminated. The values of the CurrentHue, EnhancedCurrentHue and CurrentSaturation attributes SHALL be left at their present value upon receipt of the StopMoveStep command, and the RemainingTime attribute SHALL be set to zero.

3.2.11.21. MoveColorTemperature Command

The MoveColorTemperature command allows the color temperature of a lamp to be moved at a specified rate.

The MoveColorTemperature command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	MoveMode	map8	desc			M
1	Rate	uint16	all			M
2	ColorTemperatureMinimumMireds	uint16	0 to 0xffff			M
3	ColorTemperatureMaximumMireds	uint16	0 to 0xffff			M
4	OptionsMask	map8	desc		0	M
5	OptionsOverride	map8	desc		0	M

3.2.11.21.1. MoveMode Field

This field is identical to the MoveMode field of the MoveHue command of the Color Control cluster

(see sub-clause [MoveHue Command](#)). If the MoveMode field is equal to 0 (Stop), the Rate field SHALL be ignored.

3.2.11.21.2. Rate Field

The Rate field specifies the rate of movement in steps per second. A step is a change in the color temperature of a device by one unit. If the MoveMode field is set to 1 (up) or 3 (down) and the Rate field has a value of zero, the command has no effect and a response command SHALL be sent in response, with the status code set to INVALID_COMMAND. If the MoveMode field is set to 0 (stop) the Rate field SHALL be ignored.

3.2.11.21.3. ColorTemperatureMinimumMireds Field

The ColorTemperatureMinimumMireds field specifies a lower bound on the ColorTemperatureMireds attribute (\equiv an upper bound on the color temperature in kelvins) for the current move operation such that:

$$\text{ColorTempPhysicalMinMireds} \leq \text{ColorTemperatureMinimumMireds} \text{ field} \leq \text{ColorTemperatureMireds}$$

As such if the move operation takes the ColorTemperatureMireds attribute towards the value of the ColorTemperatureMinimumMireds field it SHALL be clipped so that the above invariant is satisfied. If the ColorTemperatureMinimumMireds field is set to 0, ColorTempPhysicalMinMireds SHALL be used as the lower bound for the ColorTemperatureMireds attribute.

3.2.11.21.4. ColorTemperatureMaximumMireds Field

The ColorTemperatureMaximumMireds field specifies an upper bound on the ColorTemperatureMireds attribute (\equiv a lower bound on the color temperature in kelvins) for the current move operation such that:

$$\text{ColorTemperatureMireds} \leq \text{ColorTemperatureMaximumMireds} \text{ field} \leq \text{ColorTempPhysicalMaxMireds}$$

As such if the move operation takes the ColorTemperatureMireds attribute towards the value of the ColorTemperatureMaximumMireds field it SHALL be clipped so that the above invariant is satisfied. If the ColorTemperatureMaximumMireds field is set to 0, ColorTempPhysicalMaxMireds SHALL be used as the upper bound for the ColorTemperatureMireds attribute.

3.2.11.21.5. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.21.6. Effect on Receipt

On receipt of this command, a device SHALL set both the ColorMode and EnhancedColorMode attributes to 2. The device SHALL then move from its current color temperature in an up or down direction in a continuous fashion, as detailed in [Actions on Receipt of the MoveColorTemperature Command](#).

Table 61. Actions on Receipt of the MoveColorTemperature Command

MoveMode	Action on Receipt
Stop	If moving, stop the operation, else ignore the command (i.e., the command is accepted but has no effect).
Up	Increase the ColorTemperatureMireds attribute (= decrease the color temperature in kelvins) at the rate given in the Rate field. If the ColorTemperatureMireds attribute reaches the maximum allowed for the device (via either the ColorTemperatureMaximumMireds field or the ColorTempPhysicalMaxMireds attribute), the move operation SHALL be stopped.
Down	Decrease the ColorTemperatureMireds attribute (= increase the color temperature in kelvins) at the rate given in the Rate field. If the ColorTemperatureMireds attribute reaches the minimum allowed for the device (via either the ColorTemperatureMinimumMireds field or the ColorTempPhysicalMinMireds attribute), the move operation SHALL be stopped.

3.2.11.22. StepColorTemperature Command

The StepColorTemperature command allows the color temperature of a lamp to be stepped with a specified step size.

The StepColorTemperature command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	StepMode	map8	desc			M
1	StepSize	uint16	all			M
2	TransitionTime	uint16	0 to 65534			M
3	ColorTemperatureMinimumMireds	uint16	0 to 0xffff			M
4	ColorTemperatureMaximumMireds	uint16	0 to 0xffff			M
5	OptionsMask	map8	desc		0	M
6	OptionsOverride	map8	desc		0	M

3.2.11.22.1. StepMode Field

This field is identical to the StepMode field of the StepHue command of the Color Control cluster (see sub-clause [StepHue Command](#)).

3.2.11.22.2. StepSize Field

The StepSize field specifies the change to be added to (or subtracted from) the current value of the device's color temperature.

3.2.11.22.3. TransitionTime Field

The TransitionTime field specifies, in units of 1/10ths of a second, the time that SHALL be taken to perform the step. A step is a change to the device's color temperature of a magnitude corresponding to the StepSize field.

3.2.11.22.4. ColorTemperatureMinimumMireds Field

The ColorTemperatureMinimumMireds field specifies a lower bound on the ColorTemperatureMireds attribute (\equiv an upper bound on the color temperature in kelvins) for the current step operation such that:

$$\text{ColorTempPhysicalMinMireds} \leq \text{ColorTemperatureMinimumMireds} \text{ field} \leq \text{ColorTemperatureMireds}$$

As such if the step operation takes the ColorTemperatureMireds attribute towards the value of the Color Temperature Minimum Mireds field it SHALL be clipped so that the above invariant is satisfied. If the ColorTemperatureMinimumMireds field is set to 0, ColorTempPhysicalMinMireds SHALL be used as the lower bound for the ColorTemperatureMireds attribute.

3.2.11.22.5. ColorTemperatureMaximumMireds Field

The ColorTemperatureMaximumMireds field specifies an upper bound on the ColorTemperatureMireds attribute (\equiv a lower bound on the color temperature in kelvins) for the current step operation such that:

$$\text{ColorTemperatureMireds} \leq \text{ColorTemperatureMaximumMireds} \text{ field} \leq \text{ColorTempPhysicalMaxMireds}$$

As such if the step operation takes the ColorTemperatureMireds attribute towards the value of the ColorTemperatureMaximumMireds field it SHALL be clipped so that the above invariant is satisfied. If the ColorTemperatureMaximum Mireds field is set to 0, ColorTempPhysicalMaxMireds SHALL be used as the upper bound for the ColorTemperatureMireds attribute.

3.2.11.22.6. OptionsMask and OptionsOverride fields

The OptionsMask and OptionsOverride fields SHALL be processed according to section [Use of the OptionsMask and OptionsOverride fields](#).

3.2.11.22.7. Effect on Receipt

On receipt of this command, a device SHALL set both the ColorMode and EnhancedColorMode attributes to 2. The device SHALL then move from its current color temperature in an up or down direction by one step, as detailed in [Actions on Receipt of the StepColorTemperature Command](#).

Table 62. Actions on Receipt of the StepColorTemperature Command

StepMode	Action on Receipt
Up	Increase the ColorTemperatureMireds attribute (\equiv decrease the color temperature in kelvins) by one step. If the ColorTemperatureMireds attribute reaches the maximum allowed for the device (via either the ColorTemperatureMaximumMireds field or the ColorTempPhysicalMaxMireds attribute), the step operation SHALL be stopped.
Down	Decrease the ColorTemperatureMireds attribute (\equiv increase the color temperature in kelvins) by one step. If the ColorTemperatureMireds attribute reaches the minimum allowed for the device (via either the ColorTemperatureMinimumMireds field or the ColorTempPhysicalMinMireds attribute), the step operation SHALL be stopped.

3.3. Ballast Configuration Cluster

3.3.1. Introduction

This cluster is used for configuring a lighting ballast.

NOTE Support for Ballast Configuration cluster is provisional.

3.3.2. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	mandatory global ClusterRevision attribute added
2	CCB 2104 2193 2230 2393 Deprecated some attributes
3	CCB 2881
4	new data model format and notation

3.3.3. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	BC	Type 1 (client to server)

3.3.4. Cluster Identifiers

Identifier	Name
0x0301	Ballast Configuration

3.3.5. Dependencies

If the Alarms server cluster is supported on the same endpoint then the Alarms functionality is enabled and the LampAlarmMode attribute SHALL be supported.

3.3.6. Ballast Configuration Attribute Set

The attributes defined in this specification are arranged into sets of related attributes.

The Ballast Information attribute set contains the attributes summarized in [Attributes of the Ballast Information Attribute Set](#).

Table 63. Attributes of the Ballast Information Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	PhysicalMinLevel	uint8	1 to 254		1	R V	M
0x0001	PhysicalMaxLevel	uint8	1 to 254		254	R V	M
0x0002	BallastStatus	map8	0000 00xx		0	R V	O

3.3.6.1. PhysicalMinLevel Attribute

The PhysicalMinLevel attribute specifies the minimum light output the ballast can achieve according to the dimming light curve (see [The Dimming Light Curve](#)).

3.3.6.2. PhysicalMaxLevel Attribute

The PhysicalMaxLevel attribute specifies the maximum light output the ballast can achieve according to the dimming light curve (see [The Dimming Light Curve](#)).

3.3.6.3. BallastStatus Attribute

The BallastStatus attribute specifies the activity status of the ballast functions. The usage of the bits is specified in [Bit Usage of the BallastStatus Attribute](#). Where a function is active, the corresponding bit SHALL be set to 1. Where a function is not active, the corresponding bit SHALL be set to 0.

Table 64. Bit Usage of the BallastStatus Attribute

Bit	Function	Details
0	Ballast Non-operational	0 = The ballast is fully operational 1 = The ballast is not fully operational
1	Lamp Failure	0 = All lamps are operational 1 = One or more lamp is not in its socket or is faulty

3.3.7. Ballast Settings Attribute Set

The Ballast Settings attribute set contains the attributes summarized in [Attributes of the Ballast Settings Attribute Set](#).

Table 65. Attributes of the Ballast Settings Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0010	MinLevel	uint8	1 to 254		PhysicalMinLevel	RW VM	M
0x0011	MaxLevel	uint8	1 to 254		PhysicalMaxLevel	RW VM	M
0x0012	PowerOnLevel	uint8	1 to 254		PhysicalMaxLevel	RW VM	D
0x0013	PowerOnFadeTime	uint16	all		0	RW VM	D
0x0014	IntrinsicBallastFactor	uint8	all	X		RW VM	O
0x0015	BallastFactorAdjustment	uint8	100 to MS	X	null	RW VM	O

3.3.7.1. MinLevel Attribute

The MinLevel attribute specifies the light output of the ballast according to the dimming light curve (see [The Dimming Light Curve](#)) when the Level Control Cluster's CurrentLevel attribute equals to 1 (and the On/Off Cluster's OnOff attribute equals to TRUE).

The value of this attribute SHALL be both greater than or equal to PhysicalMinLevel and less than or equal to MaxLevel. If an attempt is made to set this attribute to a level where these conditions are not met, a response SHALL be returned with status code set to CONSTRAINT_ERROR, and the level SHALL not be set.

3.3.7.2. MaxLevel Attribute

The MaxLevel attribute specifies the light output of the ballast according to the dimming light curve (see [The Dimming Light Curve](#)) when the Level Control Cluster's CurrentLevel attribute equals to 254 (and the On/Off Cluster's OnOff attribute equals to TRUE).

The value of this attribute SHALL be both less than or equal to PhysicalMaxLevel and greater than or equal to MinLevel. If an attempt is made to set this attribute to a level where these conditions are not met, a response SHALL be returned with status code set to CONSTRAINT_ERROR, and the level SHALL not be set.

3.3.7.3. IntrinsicBallastFactor Attribute

The IntrinsicBallastFactor attribute specifies as a percentage the ballast factor of the ballast/lamp combination, prior to any adjustment.

A value of null indicates an invalid value.

3.3.7.4. BallastFactorAdjustment Attribute

The BallastFactorAdjustment attribute specifies the multiplication factor, as a percentage, to be applied to the configured light output of the lamps. A typical usage of this mechanism is to compensate for reduction in efficiency over the lifetime of a lamp.

The light output is given by

$$\text{actual light output} = \text{configured light output} \times \text{BallastFactorAdjustment} / 100\%$$

The range for this attribute is manufacturer dependent. If an attempt is made to set this attribute to a level that cannot be supported, a response SHALL be returned with status code set to CONSTRAINT_ERROR, and the level SHALL not be set. The value of null indicates that ballast factor scaling is not in use.

3.3.8. Lamp Information Attribute Set

The lamp information attribute set contains the attributes summarized in [Attributes of the Lamp Information Attribute Set](#).

Table 66. Attributes of the Lamp Information Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0020	LampQuantity	uint8	all			R V	M

3.3.8.1. LampQuantity Attribute

The LampQuantity attribute and specifies the number of lamps connected to this ballast. (**Note 1:** this number does not take into account whether lamps are actually in their sockets or not).

3.3.9. Lamp Settings Attribute Set

The Lamp Settings attribute set contains the attributes summarized in [Attributes of the Lamp Settings Attribute Set](#). If LampQuantity is greater than one, each of these attributes is taken to apply to the lamps as a set. For example, all lamps are taken to be of the same LampType with the same LampBurnHours.

Table 67. Attributes of the Lamp Settings Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0030	LampType	string	max 16		empty string	RW VM	O
0x0031	LampManufacturer	string	max 16		empty string	RW VM	O
0x0032	LampRatedHours	uint24	all	X	null	RW VM	O
0x0033	LampBurnHours	uint24	all	X	0	RW VM	O

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0034	LampAlarmMode	map8	0000 000x		0000 0000	RW VM	O
0x0035	LampBurnHoursTrip- Point	uint24	all	X	null	RW VM	O

3.3.9.1. LampType Attribute

The LampType attribute specifies the type of lamps (including their wattage) connected to the ballast.

3.3.9.2. LampManufacturer Attribute

The LampManufacturer attribute specifies the name of the manufacturer of the currently connected lamps.

3.3.9.3. LampRatedHours Attribute

The LampRatedHours attribute specifies the number of hours of use the lamps are rated for by the manufacturer.

A value of null indicates an invalid or unknown time.

3.3.9.4. LampBurnHours Attribute

The LampBurnHours attribute specifies the length of time, in hours, the currently connected lamps have been operated, cumulative since the last re-lamping. Burn hours SHALL not be accumulated if the lamps are off.

This attribute SHOULD be reset to zero (e.g., remotely) when the lamp(s) are changed. If partially used lamps are connected, LampBurnHours SHOULD be updated to reflect the burn hours of the lamps.

A value of null indicates an invalid or unknown time.

3.3.9.5. LampAlarmMode Attribute

The LampAlarmMode attribute specifies which attributes MAY cause an alarm notification to be generated, as listed in [Values of the LampAlarmMode Attribute](#). A ‘1’ in each bit position causes its associated attribute to be able to generate an alarm. (**Note:** All alarms are also logged in the alarm table – see Alarms cluster).

Table 68. Values of the LampAlarmMode Attribute

Bit	Related Attribute
0	LampBurnHours

3.3.9.6. LampBurnHoursTripPoint Attribute

The LampBurnHoursTripPoint attribute specifies the number of hours the LampBurnHours attribute MAY reach before an alarm is generated.

If the Alarms cluster is not present on the same device this attribute is not used and thus MAY be omitted (see [Dependencies](#)).

The Alarm Code field included in the generated alarm SHALL be 0x01.

If this attribute takes the value of null, then this alarm SHALL not be generated.

3.3.10. Commands

No cluster specific commands are received or generated by the server.

3.3.11. The Dimming Light Curve

The dimming curve is recommended to be logarithmic, as defined by the following equation:

$$\%Light = 10^{\left(\frac{Level-1}{\left(\frac{253}{3} \right)} \right) - 1}$$

Where: %Light is the percent light output of the ballast and

Level is an 8-bit integer between 1 (0.1% light output) and 254 (100% output) that is adjusted for MinLevel and MaxLevel using the following equation:

Level = (MaxLevel – MinLevel) * CurrentLevel / 253 + (254 * MinLevel – MaxLevel) / 253.

Note 1: Value 255 is not used.

Note 2: The light output is determined by this curve together with the IntrinsicBallastFactor and BallastFactorAdjustment attributes.

The table below gives a couple of examples of the dimming light curve for different values of MinLevel, MaxLevel and CurrentLevel.

Table 69. Examples of The Dimming Light Curve

MinLevel	MaxLevel	CurrentLevel	Level	%Light
1	254	1	1	0.10%
1	254	10	10	0.13%
1	254	100	100	1.49%
1	254	254	254	100%
170	254	1	170	10.1%
170	254	10	173	11.0%

MinLevel	MaxLevel	CurrentLevel	Level	%Light
170	254	100	203	24.8%
170	254	254	254	100%
170	230	1	170	10.1%
170	230	10	172	10.7%
170	230	100	193	19.2%
170	230	254	230	51.9%

Chapter 4. HVAC

The Cluster Library is made of individual chapters such as this one. References between chapters are made using a X.Y notation where X is the chapter and Y is the sub-section within that chapter.

4.1. General Description

4.1.1. Introduction

The clusters specified in this document are for use typically in HVAC applications, but MAY be used in any application domain.

4.1.2. Terms

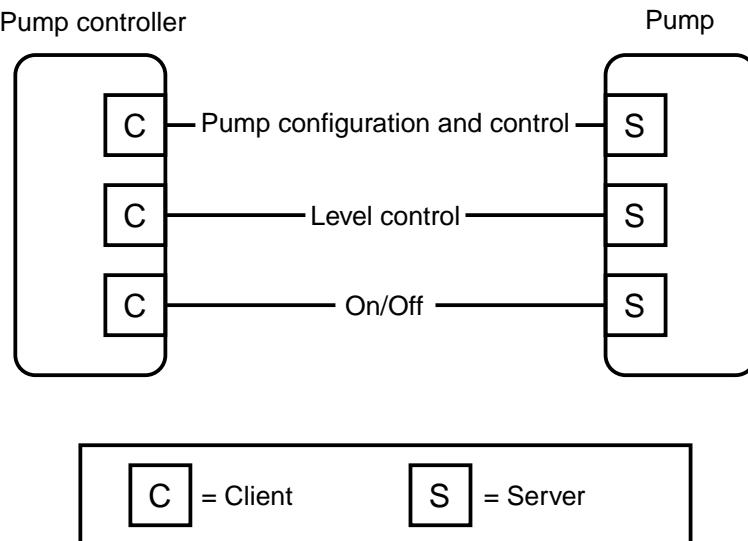
Precooling: Cooling a building in the early (cooler) part of the day, so that the thermal mass of the building decreases cooling needs in the later (hotter) part of the day.

4.1.3. Cluster List

This section lists the clusters specified in this document and gives examples of typical usage for the purpose of clarification. The clusters defined in this document are listed in [Clusters Specified in the HVAC Functional Domain](#):

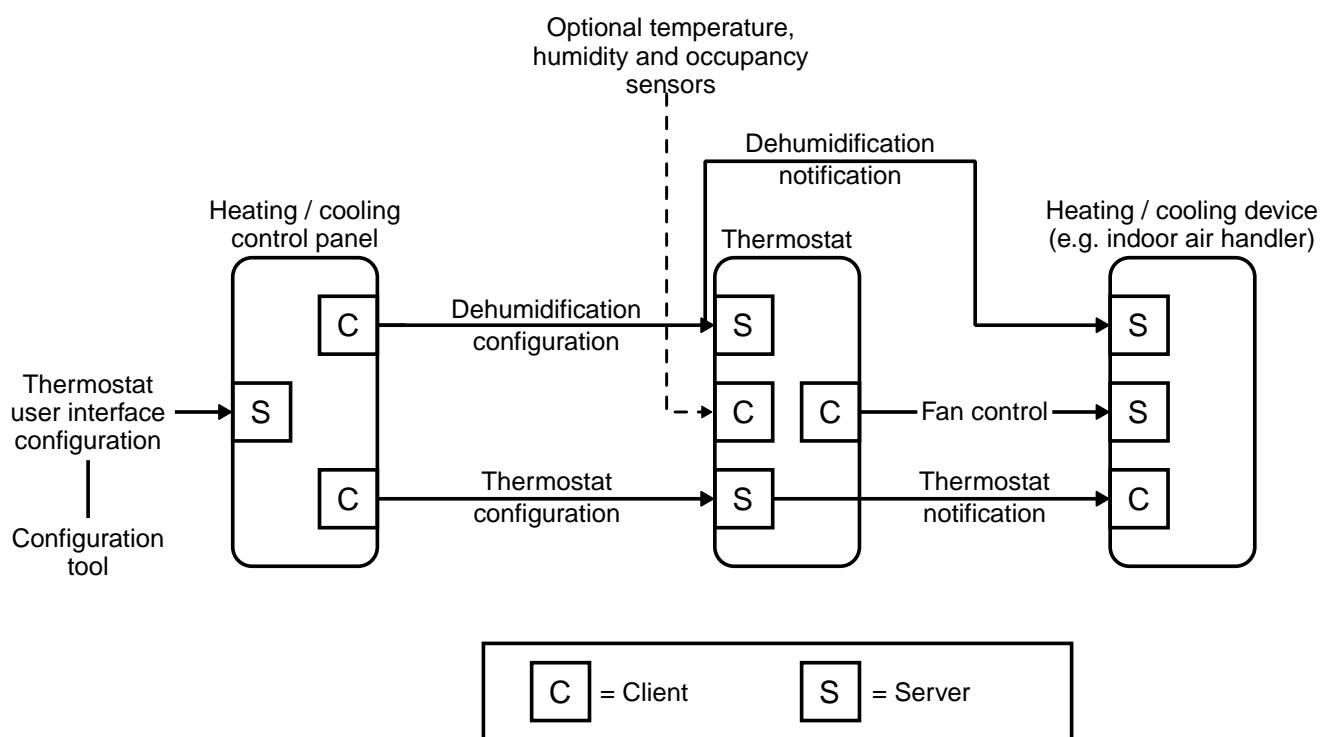
Table 70. Clusters Specified in the HVAC Functional Domain

ID	Cluster Name	Description
0x0200	Pump Configuration and Control	An interface for configuring and controlling pumps.
0x0201	Thermostat	An interface for configuring and controlling the functionality of a thermostat
0x0202	Fan Control	An interface for controlling a fan in a heating / cooling system
0x0204	Thermostat User Interface Configuration	An interface for configuring the user interface of a thermostat (which MAY be remote from the thermostat)



Note: Device names are examples for illustration purposes only

Figure 12. Typical Usage of Pump Configuration and Control Cluster



Note: Device names are examples for illustration purposes only

Figure 13. Example Usage of the Thermostat and Related Clusters"

4.2. Pump Configuration and Control Cluster

The Pump Configuration and Control cluster provides an interface for the setup and control of pump devices, and the automatic reporting of pump status information. Note that control of pump speed is not included – speed is controlled by the On/Off and Level Control clusters.

4.2.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table

below.

Revision	Description
1	Mandatory global ClusterRevision attribute added
2	All Hubs changes
3	New data model format and notation, added additional events
4	Added feature map

4.2.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	PCC

4.2.3. Cluster ID

ID	Name
0x0200	Pump Configuration and Control

4.2.4. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Conformance	Summary
0	PRSCONST	ConstantPressure	O.a+	Supports operating in constant pressure mode
1	PRSCOMP	CompensatedPressure	O.a+	Supports operating in compensated pressure mode
2	FLW	ConstantFlow	O.a+	Supports operating in constant flow mode
3	SPD	ConstantSpeed	O.a+	Supports operating in constant speed mode
4	TEMP	ConstantTemperature	O.a+	Supports operating in constant temperature mode

Bit	Code	Feature	Conformance	Summary
5	AUTO	Automatic	O	Supports operating in automatic mode
6	LOCAL	LocalOperation	O	Supports operating using local settings

4.2.5. Dependencies

Where external pressure, flow, and temperature measurements are processed by this cluster (see [ControlMode](#) attribute), these are provided by a Pressure Measurement cluster, a Flow Measurement cluster, and a Temperature Measurement client cluster, respectively. These 3 client clusters are used for connection to a remote sensor device. The pump is able to use the sensor measurement provided by a remote sensor for regulation of the pump speed.

Note that control of the pump setpoint is not included in this cluster – the On/Off and Level Control clusters (see [Typical Usage of Pump Configuration and Control Cluster](#)) MAY be used by a pump device to turn it on and off and control its setpoint. Note that the Pump Configuration and Control cluster MAY override on/off/setpoint settings for specific operation modes (See [OperationMode](#) attribute for detailed description of the operation and control of the pump.).

4.2.6. Data Types

4.2.6.1. PumpStatusBitmap

This data type is derived from map16.

Bit	Name	Summary
0	DeviceFault	A fault related to the system or pump device is detected.
1	SupplyFault	A fault related to the supply to the pump is detected.
2	SpeedLow	Setpoint is too low to achieve.
3	SpeedHigh	Setpoint is too high to achieve.
4	LocalOverride	Device control is overridden by hardware, such as an external STOP button or via a local HMI.
5	Running	Pump is currently running
6	RemotePressure	A remote pressure sensor is used as the sensor for the regulation of the pump.

Bit	Name	Summary
7	RemoteFlow	A remote flow sensor is used as the sensor for the regulation of the pump.
8	RemoteTemperature	A remote temperature sensor is used as the sensor for the regulation of the pump.

4.2.6.1.1. DeviceFault Bit

If this bit is set, it MAY correspond to an event in the range 2-16, see [Events](#).

4.2.6.1.2. SupplyFault Bit

If this bit is set, it MAY correspond to an event in the range 0-1 or 13, see [Events](#).

4.2.6.1.3. LocalOverride Bit

While this bit is set, the EffectiveOperationMode is adjusted to Local. Any request changing OperationMode SHALL generate a FAILURE error status until LocalOverride is cleared on the physical device. When LocalOverride is cleared, the device SHALL return to the operation mode set in OperationMode.

4.2.6.1.4. RemotePressure Bit

If this bit is set, EffectiveControlMode is ConstantPressure and the setpoint for the pump is interpreted as a percentage of the range of the remote sensor ([MinMeasuredValue – MaxMeasuredValue]).

4.2.6.1.5. RemoteFlow Bit

If this bit is set, EffectiveControlMode is ConstantFlow, and the setpoint for the pump is interpreted as a percentage of the range of the remote sensor ([MinMeasuredValue – MaxMeasuredValue]).

4.2.6.1.6. RemoteTemperature Bit

If this bit is set, EffectiveControlMode is ConstantTemperature, and the setpoint for the pump is interpreted as a percentage of the range of the remote sensor ([MinMeasuredValue – MaxMeasuredValue]).

4.2.6.2. OperationModeEnum

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	Normal	The pump is controlled by a setpoint, as defined by a connected remote sensor or by the ControlMode attribute.	M
1	Minimum	This value sets the pump to run at the minimum possible speed it can without being stopped.	SPD
2	Maximum	This value sets the pump to run at its maximum possible speed.	SPD
3	Local	This value sets the pump to run with the local settings of the pump, regardless of what these are.	LOCAL

4.2.6.2.1. Normal Value

If the pump is running in this operation mode the setpoint is an internal variable which MAY be controlled between 0% and 100%, e.g., by means of the Level Control cluster

4.2.6.3. ControlModeEnum

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	ConstantSpeed	The pump is running at a constant speed.	SPD
1	ConstantPressure	The pump will regulate its speed to maintain a constant differential pressure over its flanges.	PRSCONST
2	ProportionalPressure	The pump will regulate its speed to maintain a constant differential pressure over its flanges.	PRSCOMP

Value	Name	Summary	Conformance
3	ConstantFlow	The pump will regulate its speed to maintain a constant flow through the pump.	FLW
5	ConstantTemperature	The pump will regulate its speed to maintain a constant temperature.	TEMP
7	Automatic	The operation of the pump is automatically optimized to provide the most suitable performance with respect to comfort and energy savings.	AUTO

4.2.6.3.1. ConstantSpeed Value

The setpoint is interpreted as a percentage of the range derived from the [MinConstSpeed – MaxConstSpeed] attributes.

4.2.6.3.2. ConstantPressure Value

The setpoint is interpreted as a percentage of the range of the sensor used for this control mode. In case of the internal pressure sensor, this will be the range derived from the [MinConstPressure – MaxConstPressure] attributes. In case of a remote pressure sensor, this will be the range derived from the [MinMeasuredValue – MaxMeasuredValue] attributes of the remote pressure sensor.

4.2.6.3.3. ProportionalPressure Value

The setpoint is interpreted as a percentage of the range derived of the [MinCompPressure – MaxCompPressure] attributes. The internal setpoint will be lowered (compensated) dependent on the flow in the pump (lower flow ⇒ lower internal setpoint).

4.2.6.3.4. ConstantFlow Value

The setpoint is interpreted as a percentage of the range of the sensor used for this control mode. In case of the internal flow sensor, this will be the range derived from the [MinConstFlow – MaxConstFlow] attributes. In case of a remote flow sensor, this will be the range derived from the [MinMeasuredValue – MaxMeasuredValue] attributes of the remote flow sensor.

4.2.6.3.5. ConstantTemperature Value

The setpoint is interpreted as a percentage of the range of the sensor used for this control mode. In case of the internal temperature sensor, this will be the range derived from the [MinConstTemp – MaxConstTemp] attributes. In case of a remote temperature sensor, this will be the range derived from the [MinMeasuredValue – MaxMeasuredValue] attributes of the remote temperature sensor.

4.2.6.3.6. Automatic Value

This behavior is manufacturer defined. The pump can be stopped by setting the setpoint of the level control cluster to 0, or by using the On/Off cluster. If the pump is started (at any setpoint), the speed of the pump is entirely determined by the pump.

4.2.7. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	MaxPressure	int16	all	X F	null	R V	M
0x0001	MaxSpeed	uint16	all	X F	null	R V	M
0x0002	MaxFlow	uint16	all	X F	null	R V	M
0x0003	MinConst-Pressure	int16	all	X F	null	R V	PRSCONST, [AUTO]
0x0004	MaxConst-Pressure	int16	all	X F	null	R V	PRSCONST, [AUTO]
0x0005	MinComp-Pressure	int16	all	X F	null	R V	PRSCOMP, [AUTO]
0x0006	MaxComp-Pressure	int16	all	X F	null	R V	PRSCOMP, [AUTO]
0x0007	MinConst-Speed	uint16	all	X F	null	R V	SPD, [AUTO]
0x0008	MaxConst-Speed	uint16	all	X F	null	R V	SPD, [AUTO]
0x0009	MinConst-Flow	uint16	all	X F	null	R V	FLW, [AUTO]
0x000a	MaxConst-Flow	uint16	all	X F	null	R V	FLW, [AUTO]
0x000b	MinConst-Temp	int16	-27315 to max	X F	null	R V	TEMP, [AUTO]
0x000c	MaxConst-Temp	int16	-27315 to max	X F	null	R V	TEMP, [AUTO]
0x0010	PumpStatus	PumpStatusBitmap	desc	P	0	R V	O
0x0011	Effective-OperationMode	OperationModeEnum	desc	N	desc	R V	M
0x0012	Effective-ControlMode	ControlModeEnum	desc	N	desc	R V	M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0013	Capacity	int16	all	X P	null	R V	M
0x0014	Speed	uint16	all	X	null	R V	O
0x0015	Life-timeRunningHours	uint24	all	X N	0	RW VM	O
0x0016	Power	uint24	all	X	null	R V	O
0x0017	Life-timeEnergyConsumed	uint32	all	X N	0	RW VM	O
0x0020	OperationMode	Operation-ModeEnum	desc	N	0	RW VM	M
0x0021	ControlMode	ControlModeEnum	desc	N	0	RW VM	O
0x0022	Alarm-Mask	map16	desc	N	0	R V	D

4.2.7.1. MaxPressure Attribute

This attribute specifies the maximum pressure the pump can achieve. It is a physical limit, and does not apply to any specific control mode or operation mode.

Valid range is -3,276.7 kPa to 3,276.7 kPa (steps of 0.1 kPa).

This attribute SHALL be null if the value is invalid.

4.2.7.2. MaxSpeed Attribute

This attribute specifies the maximum speed the pump can achieve. It is a physical limit, and does not apply to any specific control mode or operation mode.

Valid range is 0 to 65,534 RPM (steps of 1 RPM).

This attribute SHALL be null if the value is invalid.

4.2.7.3. MaxFlow Attribute

This attribute specifies the maximum flow the pump can achieve. It is a physical limit, and does not apply to any specific control mode or operation mode.

Valid range is 0 m³/h to 6,553.4 m³/h (steps of 0.1 m³/h).

This attribute SHALL be null if the value is invalid.

4.2.7.4. MinConstPressure Attribute

This attribute specifies the minimum pressure the pump can achieve when it is working with the ControlMode attribute set to ConstantPressure.

Valid range is -3,276.7 kPa to 3,276.7 kPa (steps of 0.1 kPa).

This attribute SHALL be null if the value is invalid.

4.2.7.5. MaxConstPressure Attribute

This attribute specifies the maximum pressure the pump can achieve when it is working with the ControlMode attribute set to ConstantPressure.

Valid range is -3,276.7 kPa to 3,276.7 kPa (steps of 0.1 kPa).

This attribute SHALL be null if the value is invalid.

4.2.7.6. MinCompPressure Attribute

This attribute specifies the minimum compensated pressure the pump can achieve when it is working with the ControlMode attribute set to ProportionalPressure.

Valid range is -3,276.7 kPa to 3,276.7 kPa (steps of 0.1 kPa).

This attribute SHALL be null if the value is invalid.

4.2.7.7. MaxCompPressure Attribute

This attribute specifies the maximum compensated pressure the pump can achieve when it is working with the ControlMode attribute set to ProportionalPressure.

Valid range is -3,276.7 kPa to 3,276.7 kPa (steps of 0.1 kPa).

This attribute SHALL be null if the value is invalid.

4.2.7.8. MinConstSpeed Attribute

This attribute specifies the minimum speed the pump can achieve when it is working with the ControlMode attribute set to ConstantSpeed.

Valid range is 0 to 65,534 RPM (steps of 1 RPM).

This attribute SHALL be null if the value is invalid.

4.2.7.9. MaxConstSpeed Attribute

This attribute specifies the maximum speed the pump can achieve when it is working with the ControlMode attribute set to ConstantSpeed.

Valid range is 0 to 65,534 RPM (steps of 1 RPM).

This attribute SHALL be null if the value is invalid.

4.2.7.10. MinConstFlow Attribute

This attribute specifies the minimum flow the pump can achieve when it is working with the Con-

trolMode attribute set to ConstantFlow.

Valid range is 0 m³/h to 6,553.4 m³/h (steps of 0.1 m³/h).

This attribute SHALL be null if the value is invalid.

4.2.7.11. MaxConstFlow Attribute

This attribute specifies the maximum flow the pump can achieve when it is working with the ControlMode attribute set to ConstantFlow.

Valid range is 0 m³/h to 6,553.4 m³/h (steps of 0.1 m³/h).

This attribute SHALL be null if the value is invalid.

4.2.7.12. MinConstTemp Attribute

This attribute specifies the minimum temperature the pump can maintain in the system when it is working with the ControlMode attribute set to ConstantTemperature.

Valid range is –273.15 °C to 327.67 °C (steps of 0.01 °C).

This attribute SHALL be null if the value is invalid.

4.2.7.13. MaxConstTemp Attribute

This attribute specifies the maximum temperature the pump can maintain in the system when it is working with the ControlMode attribute set to ConstantTemperature.

MaxConstTemp SHALL be greater than or equal to MinConstTemp

Valid range is –273.15 °C to 327.67 °C (steps of 0.01 °C).

This attribute SHALL be null if the value is invalid.

4.2.7.14. PumpStatus Attribute

This attribute specifies the activity status of the pump functions as listed in [PumpStatusBitmap](#). Where a pump controller function is active, the corresponding bit SHALL be set to 1. Where a pump controller function is not active, the corresponding bit SHALL be set to 0.

4.2.7.15. EffectiveOperationMode Attribute

This attribute specifies current effective operation mode of the pump as defined in [OperationModeEnum](#).

The value of the EffectiveOperationMode attribute is the same as the OperationMode attribute, unless one of the following points are true:

- The pump is physically set to run with the local settings
- The LocalOverride bit in the PumpStatus attribute is set,

See [OperationMode](#) and [ControlMode](#) attributes for a detailed description of the operation and control of the pump.

4.2.7.16. EffectiveControlMode Attribute

This attribute specifies the current effective control mode of the pump as defined in [ControlModeEnum](#).

This attribute contains the control mode that currently applies to the pump. It will have the value of the ControlMode attribute, unless one of the following points are true:

- The ControlMode attribute is set to Automatic. In this case, the value of the EffectiveControlMode SHALL match the behavior of the pump.
- A remote sensor is used as the sensor for regulation of the pump. In this case, EffectiveControlMode will display ConstantPressure, ConstantFlow or ConstantTemperature if the remote sensor is a pressure sensor, a flow sensor or a temperature sensor respectively, regardless of the value of the ControlMode attribute.

In case the ControlMode attribute is not included on the device and no remote sensors are connected, the value of the EffectiveControlMode SHALL match the vendor-specific behavior of the pump.

See [OperationMode](#) and [ControlMode](#) attributes for detailed a description of the operation and control of the pump.

4.2.7.17. Capacity Attribute

This attribute specifies the actual capacity of the pump as a percentage of the effective maximum setpoint value. It is updated dynamically as the speed of the pump changes.

If the value is not available (the measurement or estimation of the speed is done in the pump), this attribute will indicate the null value.

Valid range is 0 % to 163.835% (0.005 % granularity). Although this attribute is a signed value, values of capacity less than zero have no physical meaning.

4.2.7.18. Speed Attribute

This attribute specifies the actual speed of the pump measured in RPM. It is updated dynamically as the speed of the pump changes.

If the value is not available (the measurement or estimation of the speed is done in the pump), this attribute will indicate the null value.

Valid range is 0 to 65.534 RPM.

4.2.7.19. LifetimeRunningHours Attribute

This attribute specifies the accumulated number of hours that the pump has been powered and the motor has been running. It is updated dynamically as it increases. It is preserved over power cycles of the pump. If LifeTimeRunningHours rises above maximum value it “rolls over” and starts at 0 (zero).

This attribute is writeable, in order to allow setting to an appropriate value after maintenance. If

the value is not available, this attribute will indicate the null value.

Valid range is 0 to 16,777,214 hrs.

4.2.7.20. Power Attribute

This attribute specifies the actual power consumption of the pump in Watts. The value of this attribute is updated dynamically as the power consumption of the pump changes.

This attribute is read only. If the value is not available (the measurement of power consumption is not done in the pump), this attribute will indicate the null value.

Valid range is 0 to 16,777,214 Watts.

4.2.7.21. LifetimeEnergyConsumed Attribute

This attribute specifies the accumulated energy consumption of the pump through the entire lifetime of the pump in kWh. The value of the LifetimeEnergyConsumed attribute is updated dynamically as the energy consumption of the pump increases. If LifetimeEnergyConsumed rises above maximum value it “rolls over” and starts at 0 (zero).

This attribute is writeable, in order to allow setting to an appropriate value after maintenance.

Valid range is 0 kWh to 4,294,967,294 kWh.

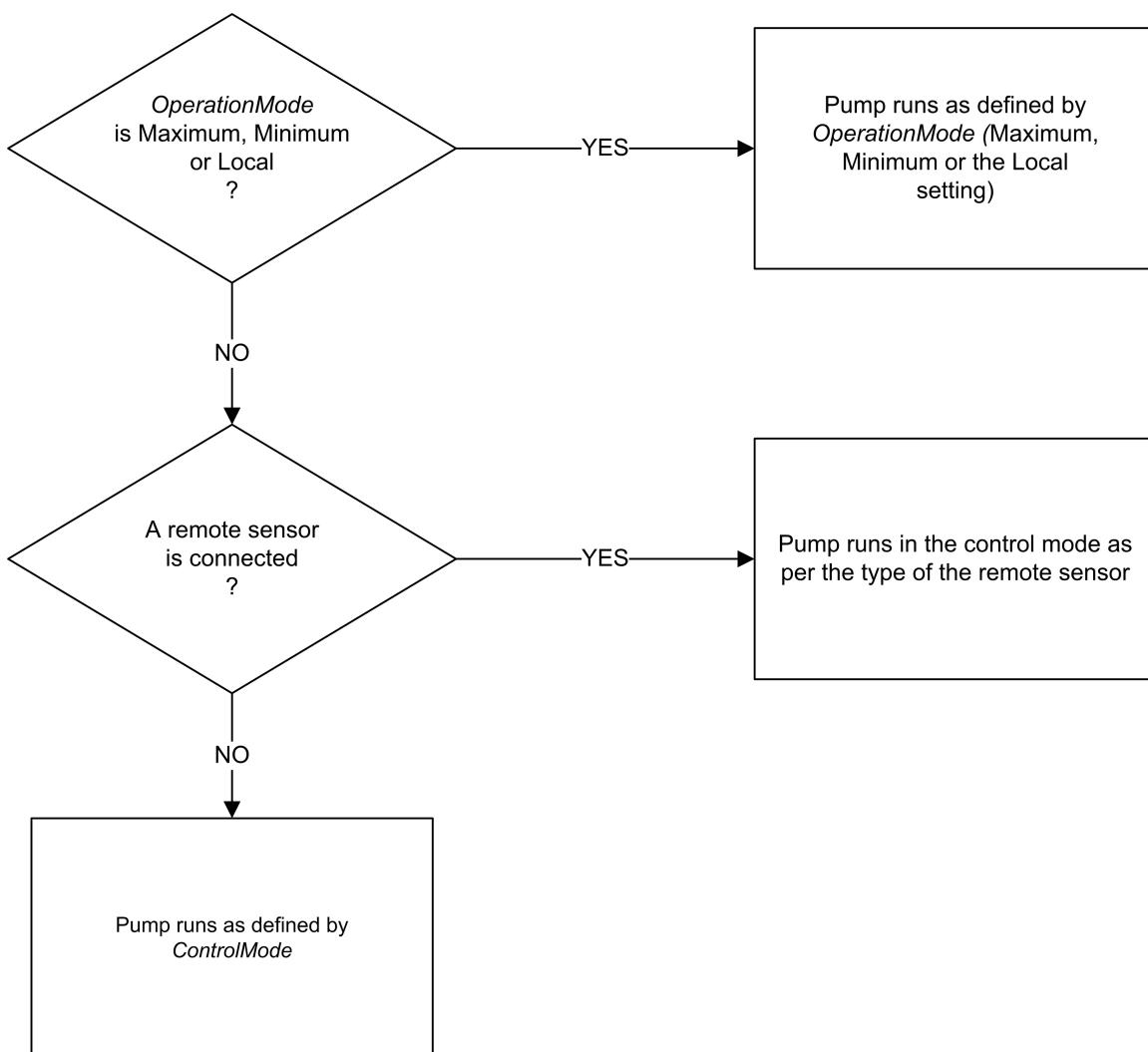
This attribute SHALL be null if the value is unknown.

4.2.7.22. OperationMode Attribute

This attribute specifies the operation mode of the pump as defined in [OperationModeEnum](#).

The actual operating mode of the pump is a result of the setting of the attributes OperationMode, ControlMode and the optional connection of a remote sensor. The operation and control is prioritized as shown in the scheme below:

Priority Scheme of Pump Operation and Control



If this attribute is Maximum, Minimum or Local, the OperationMode attribute decides how the pump is operated.

If this attribute is Normal and a remote sensor is connected to the pump, the type of the remote sensor decides the control mode of the pump. A connected remote pressure sensor will make the pump run in control mode Constant pressure and vice versa for flow and temperature type sensors. This is regardless of the setting of the ControlMode attribute.

If this attribute is Normal and no remote sensor is connected, the control mode of the pump is decided by the ControlMode attribute.

OperationMode MAY be changed at any time, even when the pump is running. The behavior of the pump at the point of changing the value of this attribute is vendor-specific.

In the case a device does not support a specific operation mode, the write interaction to this attribute with an unsupported operation mode value SHALL be ignored and a response containing the status of CONSTRAINT_ERROR SHALL be returned.

4.2.7.23. ControlMode Attribute

This attribute specifies the control mode of the pump as defined in [ControlModeEnum](#).

See the [OperationMode](#) attribute for a detailed description of the operation and control of the

pump.

ControlMode MAY be changed at any time, even when the pump is running. The behavior of the pump at the point of changing is vendor-specific.

In the case a device does not support a specific control mode, the write interaction to this attribute with an unsupported control mode value SHALL be ignored and a response containing the status of CONSTRAINT_ERROR SHALL be returned.

4.2.8. Events

ID	Name	Priority	Access	Conformance
0x00	SupplyVoltageLow	INFO	V	O
0x01	SupplyVoltageHigh	INFO	V	O
0x02	PowerMissingPhase	INFO	V	O
0x03	SystemPressureLow	INFO	V	O
0x04	SystemPressureHigh	INFO	V	O
0x05	DryRunning	CRITICAL	V	O
0x06	MotorTemperatureHigh	INFO	V	O
0x07	PumpMotorFatalFailure	CRITICAL	V	O
0x08	ElectronicTemperatureHigh	INFO	V	O
0x09	PumpBlocked	CRITICAL	V	O
0x0a	SensorFailure	INFO	V	O
0x0b	ElectronicNonFatalFailure	INFO	V	O
0x0c	ElectronicFatalFailure	CRITICAL	V	O
0x0d	GeneralFault	INFO	V	O
0x0e	Leakage	INFO	V	O
0x0f	AirDetection	INFO	V	O
0x10	TurbineOperation	INFO	V	O

4.3. Thermostat Cluster

This cluster provides an interface to the functionality of a thermostat.

4.3.1. Revision History

The global *ClusterRevision* attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	mandatory global <i>ClusterRevision</i> attribute added; fixed some defaults; CCB 1823, 1480
2	CCB 1981 2186 2249 2250 2251; NFR Thermostat Setback
3	CCB 2477 2560 2773 2777 2815 2816 3029
4	All Hubs changes
5	New data model format and notation, added FeatureMap, collapsed attribute sets, clarified edge cases around limits, default value of xxxSetpointLimit now respects AbsxxxSetpointLimit
6	Introduced the LTNE feature and adapted text (spec issue #5778)

4.3.2. Classification

Hierarchy	Role	Context	PICS Code	Primary Transaction
Base	Application	Endpoint	TSTAT	Type 2 (server to client)

4.3.3. Cluster Identifiers

Identifier	Name
0x0201	Thermostat

4.3.3.1. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description	Conformance
0	HEAT	Heating	Thermostat is capable of managing a heating device	AUTO, O.a+

Bit	Code	Feature	Description	Conformance
1	COOL	Cooling	Thermostat is capable of managing a cooling device	AUTO, O.a+
2	OCC	Occupancy	Supports Occupied and Unoccupied setpoints	O
3	SCH	Schedule Configuration	Supports remote configuration of a weekly schedule of setpoint transitions	O
4	SB	Setback	Supports configurable setback (or span)	O
5	AUTO	Auto Mode	Supports a System Mode of Auto	O
6	LTNE	Local Temperature Not Exposed	Thermostat does not expose the LocalTemperature Value in the LocalTemperature attribute	O

4.3.3.1.1. Local Temperature Not Exposed (LTNE) feature

This feature indicates that the [LocalTemperature Value](#) used internally is unavailable to report externally, for example due to the temperature control being done by a separate subsystem which does not offer a view into the currently measured temperature, but allows setpoints to be provided.

4.3.4. Units of Temperature

Temperatures within this cluster are represented by types using units of degree Celsius.

While temperature values MUST be transferred over the air using these types, this does not limit how Thermostats may display or store temperature values. Thermostats which display temperature values SHOULD follow the recommendations in [Conversion of Temperature Values for Display](#)

Calculations with temperature attributes

CAUTION

Where calculations or comparisons are performed, attribute values must be converted to a common type. In many cases, it is not sufficient to simply use the integer representation as the scaling from °C to integer value differs.

4.3.5. Setpoint Limits

There are a number of attributes which impose limits on setpoint values. This imposes constraints which MUST be maintained by any mechanism which modifies a limit or setpoint. Individual attribute descriptions detail the actions to be taken should a conflict arise while modifying the value.

User configurable limits must be within device limits:

- $\text{AbsMinHeatSetpointLimit} \leq \text{MinHeatSetpointLimit} \leq \text{MaxHeatSetpointLimit} \leq \text{AbsMaxHeatSetpointLimit}$
- $\text{AbsMinCoolSetpointLimit} \leq \text{MinCoolSetpointLimit} \leq \text{MaxCoolSetpointLimit} \leq \text{AbsMaxCoolSetpointLimit}$

Setpoints must be within user configurable limits:

- $\text{MinHeatSetpointLimit} \leq \text{OccupiedHeatingSetpoint} \leq \text{MaxHeatSetpointLimit}$
- $\text{MinCoolSetpointLimit} \leq \text{OccupiedCoolingSetpoint} \leq \text{MaxCoolSetpointLimit}$
- $\text{MinHeatSetpointLimit} \leq \text{UnoccupiedHeatingSetpoint} \leq \text{MaxHeatSetpointLimit}$
- $\text{MinCoolSetpointLimit} \leq \text{UnoccupiedCoolingSetpoint} \leq \text{MaxCoolSetpointLimit}$

and if, and only if, the AUTO feature is supported, a deadband must be maintained between Heating and Cooling setpoints and limits:

- $\text{AbsMinHeatSetpointLimit} \leq (\text{AbsMinCoolSetpointLimit} - \text{MinSetpointDeadBand})$
- $\text{AbsMaxHeatSetpointLimit} \leq (\text{AbsMaxCoolSetpointLimit} - \text{MinSetpointDeadBand})$
- $\text{MinHeatSetpointLimit} \leq (\text{MinCoolSetpointLimit} - \text{MinSetpointDeadBand})$
- $\text{MaxHeatSetpointLimit} \leq (\text{MaxCoolSetpointLimit} - \text{MinSetpointDeadBand})$
- $\text{OccupiedHeatingSetpoint} \leq (\text{OccupiedCoolingSetpoint} - \text{MinSetpointDeadBand})$
- $\text{UnoccupiedHeatingSetpoint} \leq (\text{UnoccupiedCoolingSetpoint} - \text{MinSetpointDeadBand})$

4.3.6. Dependencies

If the Alarms server cluster is supported on the same endpoint then the Alarms functionality is enabled and the AlarmMask attribute SHALL be supported. For remote temperature sensing, the Temperature Measurement client cluster MAY be included on the same endpoint. For occupancy sensing, the Occupancy Sensing client cluster MAY be included on the same endpoint.

4.3.7. Attributes

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	LocalTemperature	temperature	all	XP	null	R V	M

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0001	Out-doorTemperature	temperature	all	X	null	R V	O
0x0002	Occupancy	map8	desc		1	R V	OCC
0x0003	AbsMin-HeatSet-pointLimit	temperature	desc	F	7°C	R V	[HEAT]
0x0004	AbsMax-HeatSet-pointLimit	temperature	desc	F	30°C	R V	[HEAT]
0x0005	AbsMin-CoolSet-pointLimit	temperature	desc	F	16°C	R V	[COOL]
0x0006	AbsMax-CoolSet-pointLimit	temperature	desc	F	32°C	R V	[COOL]
0x0007	PICool-ingDemand	uint8	0% to 100%	P	-	R V	[COOL]
0x0008	PIHeatingDemand	uint8	0% to 100%	P	-	R V	[HEAT]
0x0009	HVACSystemType-Configuration	map8	desc	N	0	R[W] VM	D
0x0010	LocalTemperature-Calibration	temp-s8	-2.5°C to 2.5°C	N	0°C	RW VM	[!LTNE]
0x0011	Occupied-CoolingSet-point	temperature	desc	NS	26°C	RW VO	COOL
0x0012	Occupied-HeatingSet-point	temperature	desc	NS	20°C	RW VO	HEAT

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0013	UnoccupiedCoolingSet-point	temperature	desc	N	26°C	RW VO	COOL & OCC
0x0014	UnoccupiedHeatingSet-point	temperature	desc	N	20°C	RW VO	HEAT & OCC
0x0015	MinHeatSet-pointLimit	temperature	desc	N	AbsMin-HeatSet-pointLimit	RW VM	[HEAT]
0x0016	MaxHeatSet-pointLimit	temperature	desc	N	AbsMax-HeatSet-pointLimit	RW VM	[HEAT]
0x0017	Min-CoolSet-pointLimit	temperature	desc	N	AbsMin-CoolSet-pointLimit	RW VM	[COOL]
0x0018	Max-CoolSet-pointLimit	temperature	desc	N	AbsMax-CoolSet-pointLimit	RW VM	[COOL]
0x0019	MinSet-point-DeadBand	temp-s8	0°C to 2.5°C	N	2.5°C	R[W] VM	AUTO
0x001a	Remote-Sensing	map8	00000xxx	N	0	RW VM	O
0x001b	ControlSequenceOf-Operation	enum8	desc	N	4	RW VM	M
0x001c	System-Mode	enum8	desc	NS	1	RW VM	M
0x001d	Alarm-Mask	map8	desc		0	R V	O
0x001e	Thermosta-tRunning-Mode	enum8	desc		0	R V	[AUTO]
0x0020	StartOfWeek	enum8	desc	F	-	R V	SCH

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0021	NumberOfWeeklyTransitions	uint8	all	F	0	R V	SCH
0x0022	NumberOfDailyTransitions	uint8	all	F	0	R V	SCH
0x0023	TemperatureSetpointHold	enum8	desc	N	0	RW VM	O
0x0024	TemperatureSetpointHoldDuration	uint16	0 to 1440	NX	null	RW VM	O
0x0025	Thermostat-ProgrammingOperationMode	map8	desc	P	0	RW VM	O
0x0029	Thermostat-RunningState	map16	desc	-	-	R V	O
0x0030	SetpointChangeSource	enum8	desc	-	0	R V	O
0x0031	SetpointChangeAmount	temp-diff	all	X	null	R V	O
0x0032	SetpointChangeSourceTimestamp	utc	all	-	0	R V	O
0x0034	Occupied-Setback	temp-u8	Occupied-Setback-Min to Occupied-Setback-Max	XN	null	RW VM	SB

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0035	Occupied-Setback-Min	temp-u8	0 to OccupiedSetbackMax	XF	null	R V	SB
0x0036	Occupied-Setback-Max	temp-u8	Occupied-Setback-Min to 25.4°C	XF	null	R V	SB
0x0037	UnoccupiedSetback	temp-u8	UnoccupiedSetbackMin to UnoccupiedSetbackMax	XN	null	RW VM	SB & OCC
0x0038	UnoccupiedSetbackMin	temp-u8	0 to UnoccupiedSetbackMax	XF	null	R V	SB & OCC
0x0039	UnoccupiedSetbackMax	temp-u8	UnoccupiedSetbackMin to 25.4°C	XF	null	R V	SB & OCC
0x003a	EmergencyHeat-Delta	temp-u8	all	N	25.5°C	RW VM	O
0x0040	ACType	enum8	desc	N	0	RW VM	O
0x0041	ACCapacity	uint16	all	N	0	RW VM	O
0x0042	ACRefrigerantType	enum8	desc	N	0	RW VM	O
0x0043	ACCompressorType	enum8	desc	N	0	RW VM	O
0x0044	ACError-Code	map32	all		0	RW VM	O
0x0045	ACLouver-Position	enum8	desc	N	0	RW VM	O
0x0046	ACCoil-Temperature	temperature	all	X	null	R V	O
0x0047	ACCapacityFormat	enum8	desc	N	0	RW VM	O

4.3.7.1. LocalTemperature Value

This value represents the current temperature, as measured locally or remotely (over the network), including any adjustments applied by *LocalTemperatureCalibration* attribute (if any) as follows:

$$\text{LocalTemperature} = (\text{measured temperature}) + \text{LocalTemperatureCalibration}.$$

All setpoint attributes in the Thermostat cluster SHALL be triggered based off the LocalTemperature value (i.e., measured temperature and any calibration offset).

If the Local Temperature Not Exposed (LTNE) feature is present, the behavior of the thermostat SHALL be that the equipment's temperature control uses the LocalTemperature value even if the current value of LocalTemperature is not reported in the [LocalTemperature Attribute](#).

4.3.7.2. LocalTemperature Attribute

This attribute indicates the current [LocalTemperature value](#), when available. The value may be local, or remote, depending on the value of the [RemoteSensing attribute](#) when supported.

- If the **LTNE** feature is not supported:
 - If the temperature measurement is invalid or currently unavailable, the attribute SHALL report **null**.
 - If the temperature measurement is valid, the attribute SHALL report that value.
- Otherwise, if the **LTNE** feature is supported, there is no feedback externally available for the LocalTemperature value. In that case, the LocalTemperature attribute SHALL always report **null**.

4.3.7.3. OutdoorTemperature Attribute

This attribute represents the outdoor temperature, as measured locally or remotely (over the network).

4.3.7.4. Occupancy Attribute

This attribute specifies whether the heated/cooled space is occupied or not, as measured locally or remotely (over the network). If bit 0 = 1, the space is occupied, else it is unoccupied. All other bits are reserved.

4.3.7.5. AbsMinHeatSetpointLimit Attribute

This attribute specifies the absolute minimum level that the heating setpoint MAY be set to. This is a limitation imposed by the manufacturer.

Refer to [Setpoint Limits](#) for constraints

4.3.7.6. AbsMaxHeatSetpointLimit Attribute

This attribute specifies the absolute maximum level that the heating setpoint MAY be set to. This is a limitation imposed by the manufacturer.

Refer to [Setpoint Limits](#) for constraints

4.3.7.7. AbsMinCoolSetpointLimit Attribute

This attribute specifies the absolute minimum level that the cooling setpoint MAY be set to. This is a limitation imposed by the manufacturer.

Refer to [Setpoint Limits](#) for constraints

4.3.7.8. AbsMaxCoolSetpointLimit Attribute

This attribute specifies the absolute maximum level that the cooling setpoint MAY be set to. This is a limitation imposed by the manufacturer.

Refer to [Setpoint Limits](#) for constraints

4.3.7.9. PICoolingDemand Attribute

This attribute specifies the level of cooling demanded by the PI (proportional integral) control loop in use by the thermostat (if any), in percent. This value is 0 when the thermostat is in “off” or “heating” mode.

This attribute is reported regularly and MAY be used to control a cooling device.

4.3.7.10. PIHeatingDemand Attribute

This attribute specifies the level of heating demanded by the PI loop in percent. This value is 0 when the thermostat is in “off” or “cooling” mode.

This attribute is reported regularly and MAY be used to control a heating device.

4.3.7.11. HVACSystemTypeConfiguration Attribute

This attribute specifies the HVAC system type controlled by the thermostat. If the thermostat uses physical DIP switches to set these parameters, this information SHALL be available read-only from the DIP switches. If these parameters are set via software, there SHALL be read/write access in order to provide remote programming capability. The meanings of individual bits are detailed below. Each bit represents a type of system configuration.

Table 71. HVAC System Type Configuration Values

Bit	Name	Description
0 – 1	CoolingStage	00 – Cool Stage 1 01 – Cool Stage 2 10 – Cool Stage 3 11 – Reserved
2 – 3	HeatingStage	00 – Heat Stage 1 01 – Heat Stage 2 10 – Heat Stage 3 11 – Reserved

Bit	Name	Description
4	HeatingType	0 – Conventional 1 – Heat Pump
5	HeatingFuel	0 – Electric / B 1 – Gas / O

4.3.7.12. LocalTemperatureCalibration Attribute

This attribute specifies the offset the Thermostat server SHALL make to the measured temperature (locally or remotely) to adjust the [LocalTemperature Value](#) prior to using, displaying or reporting it.

The purpose of this attribute is to adjust the calibration of the Thermostat server per the user's preferences (e.g., to match if there are multiple servers displaying different values for the same HVAC area) or compensate for variability amongst temperature sensors.

If a Thermostat client attempts to write *LocalTemperatureCalibration* attribute to an unsupported value (e.g., out of the range supported by the Thermostat server), the Thermostat server SHALL respond with a status of SUCCESS and set the value of *LocalTemperatureCalibration* to the upper or lower limit reached.

4.3.7.13. OccupiedCoolingSetpoint Attribute

This attribute specifies the cooling mode setpoint when the room is occupied.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute such that these constraints are violated, a response with the status code CONSTRAINT_ERROR SHALL be returned.

If the occupancy status of the room is unknown, this attribute SHALL be used as the cooling mode setpoint.

4.3.7.14. OccupiedHeatingSetpoint Attribute

This attribute specifies the heating mode setpoint when the room is occupied.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute such that these constraints are violated, a response with the status code CONSTRAINT_ERROR SHALL be returned.

If the occupancy status of the room is unknown, this attribute SHALL be used as the heating mode setpoint.

4.3.7.15. UnoccupiedCoolingSetpoint Attribute

This attribute specifies the cooling mode setpoint when the room is unoccupied.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute such that these constraints are violated, a response with the status code CONSTRAINT_ERROR SHALL be returned.

If the occupancy status of the room is unknown, this attribute SHALL not be used.

4.3.7.16. UnoccupiedHeatingSetpoint Attribute

This attribute specifies the heating mode setpoint when the room is unoccupied.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute such that these constraints are violated, a response with the status code CONSTRAINT_ERROR SHALL be returned.

If the occupancy status of the room is unknown, this attribute SHALL not be used.

4.3.7.17. MinHeatSetpointLimit Attribute

This attribute specifies the minimum level that the heating setpoint MAY be set to.

This attribute, and the following three attributes, allow the user to define setpoint limits more constrictive than the manufacturer imposed ones. Limiting users (e.g., in a commercial building) to such setpoint limits can help conserve power.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute to a value which conflicts with setpoint values then those setpoints SHALL be adjusted by the minimum amount to permit this attribute to be set to the desired value. If an attempt is made to set this attribute to a value which is not consistent with the constraints and cannot be resolved by modifying setpoints then a response with the status code CONSTRAINT_ERROR SHALL be returned.

4.3.7.18. MaxHeatSetpointLimit Attribute

This attribute specifies the maximum level that the heating setpoint MAY be set to.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute to a value which conflicts with setpoint values then those setpoints SHALL be adjusted by the minimum amount to permit this attribute to be set to the desired value. If an attempt is made to set this attribute to a value which is not consistent with the constraints and cannot be resolved by modifying setpoints then a response with the status code CONSTRAINT_ERROR SHALL be returned.

4.3.7.19. MinCoolSetpointLimit Attribute

This attribute specifies the minimum level that the cooling setpoint MAY be set to.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute to a value which conflicts with setpoint values then those setpoints SHALL be adjusted by the minimum amount to permit this attribute to be set to the desired value. If an attempt is made to set this attribute to a value which is not consistent with the constraints and cannot be resolved by modifying setpoints then a response with the status code CONSTRAINT_ERROR SHALL be returned.

4.3.7.20. MaxCoolSetpointLimit Attribute

This attribute specifies the maximum level that the cooling setpoint MAY be set to.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute to a value which conflicts with setpoint values then those setpoints SHALL be adjusted by the minimum amount to permit this attribute to be set to the desired value. If an attempt is made to set this attribute to a value which is not consistent with the constraints and cannot be resolved by modifying setpoints

then a response with the status code CONSTRAINT_ERROR SHALL be returned.

4.3.7.21. MinSetpointDeadBand Attribute

On devices which support the AUTO feature, this attribute specifies the minimum difference between the Heat Setpoint and the Cool Setpoint.

Refer to [Setpoint Limits](#) for constraints. If an attempt is made to set this attribute to a value which conflicts with setpoint values then those setpoints SHALL be adjusted by the minimum amount to permit this attribute to be set to the desired value. If an attempt is made to set this attribute to a value which is not consistent with the constraints and cannot be resolved by modifying setpoints then a response with the status code CONSTRAINT_ERROR SHALL be returned.

4.3.7.22. RemoteSensing Attribute

This attribute indicates when the local temperature, outdoor temperature and occupancy are being sensed by remote networked sensors, rather than internal sensors.

A bit set to 1 indicates remote sensing of the relevant value.

Table 72. RemoteSensing Attribute Bit Values

Bit	Name	Description	Conformance
0	LocalTemperature	When set, LocalTemperature Value is derived from a remote node	M
1	OutdoorTemperature	When set, OutdoorTemperature is derived from a remote node	OutdoorTemperature
2	Occupancy	When set, Occupancy is derived from a remote node	OCC

If the [LTNE](#) feature is present in the server, the **LocalTemperature** RemoteSensing bit value SHALL always report a value of 0.

If the **LocalTemperature** RemoteSensing bit is written with a value of 1 when the [LTNE](#) feature is present, the write SHALL fail and the server SHALL report a CONSTRAINT_ERROR.

4.3.7.23. ControlSequenceOfOperation Attribute

This attribute specifies the overall operating environment of the thermostat, and thus the possible system modes that the thermostat can operate in. It SHALL be set to one of the following values.

Table 73. ControlSequenceOfOperation Values

Value	Name	Conformance	Description
0	CoolingOnly	[COOL]	Heat and Emergency are not possible
1	CoolingWithReheat	[COOL]	Heat and Emergency are not possible
2	HeatingOnly	[HEAT]	Cool and precooling (see Terms) are not possible
3	HeatingWithReheat	[HEAT]	Cool and precooling are not possible
4	CoolingAndHeating	[HEAT & COOL]	All modes are possible
5	CoolingAndHeating-WithReheat	[HEAT & COOL]	All modes are possible

CoolingAndHeating

NOTE

A thermostat indicating it supports CoolingAndHeating (or CoolingAndHeatingWithReheat) SHOULD be able to request heating or cooling on demand and will usually support the Auto SystemMode.

Systems which support cooling **or** heating, requiring external intervention to change modes or where the whole building must be in the same mode, SHOULD report CoolingOnly or HeatingOnly based on the current capability.

4.3.7.24. SystemMode Attribute

This attribute specifies the current operating mode of the thermostat, It SHALL be set to one of the following values, as limited by the [ControlSequenceOfOperation Attribute](#).

NOTE It is not mandatory to support all values.

Table 74. SystemMode Values

Value	Name	Conformance	Description
0	Off	O	The Thermostat does not generate demand for Cooling or Heating
1	Auto	AUTO	Demand is generated for either Cooling or Heating, as required
3	Cool	[COOL]	Demand is only generated for Cooling
4	Heat	[HEAT]	Demand is only generated for Heating

Value	Name	Conformance	Description
5	EmergencyHeat	[HEAT]	2 nd stage heating is in use to achieve desired temperature
6	Precooling	[COOL]	(see Terms)
7	Fan only	O	
8	Dry	O	
9	Sleep	O	

Table 75. Interpretation of Heat, Cool and Auto SystemMode Values

Attribute Values	Temperature Below Heat Setpoint	Temperature Between Heat Setpoint and Cool Setpoint	Temperature Above Cool Setpoint
Heat	Temperature below target	Temperature on target	Temperature on target
Cool	Temperature on target	Temperature on target	Temperature above target
Auto	Temperature below target	Temperature on target	Temperature above target

4.3.7.25. AlarmMask Attribute

This attribute specifies whether each of the alarms listed below is enabled. When the bit number corresponding to the alarm code is set to 1, the alarm is enabled, else it is disabled. Bits not corresponding to a code in the table are reserved.

When the Alarms cluster is implemented on a device, and one of the alarm conditions included in this table occurs, an alarm notification is generated, with the alarm code field set as listed in the table.

Table 76. Alarm Codes

Alarm Code	Alarm Condition
0	Initialization failure. The device failed to complete initialization at power-up.
1	Hardware failure
2	Self-calibration failure

4.3.7.26. Thermostat Running Mode Attribute

This attribute represents the running mode of the thermostat. This attribute uses the [SystemMode Values](#) but can only be Off, Cool or Heat. This attribute is intended to provide additional information when the thermostat's system mode is in auto mode.

4.3.7.27. StartOfWeek Attribute

This attribute represents the day of the week that this thermostat considers to be the start of week for weekly set point scheduling.

Table 77. StartOfWeek Values

Value	Name	Conformance	Description
0	Sunday	M	
1	Monday	M	
2	Tuesday	M	
3	Wednesday	M	
4	Thursday	M	
5	Friday	M	
6	Saturday	M	

This attribute MAY be able to be used as the base to determine if the device supports weekly scheduling by reading the attribute. Successful response means that the weekly scheduling is supported.

4.3.7.28. NumberOfWeeklyTransitions Attribute

This attribute determines how many weekly schedule transitions the thermostat is capable of handling.

4.3.7.29. NumberOfDailyTransitions Attribute

This attribute determines how many daily schedule transitions the thermostat is capable of handling.

4.3.7.30. TemperatureSetpointHold Attribute

This attribute specifies the temperature hold status on the thermostat. If hold status is on, the thermostat SHOULD maintain the temperature set point for the current mode until a system mode change. If hold status is off, the thermostat SHOULD follow the setpoint transitions specified by its internal scheduling program. If the thermostat supports setpoint hold for a specific duration, it SHOULD also implement the *TemperatureSetpointHoldDuration* attribute.

Table 78. TemperatureSetpointHold Values

Value	Name	Conformance	Description
0	SetpointHoldOff	M	Follow scheduling program
1	SetpointHoldOn	M	Maintain current set-point, regardless of schedule transitions

4.3.7.31. TemperatureSetpointHoldDuration Attribute

This attribute sets the period in minutes for which a setpoint hold is active. Thermostats that support hold for a specified duration SHOULD implement this attribute. The null value indicates the field is unused. All other values are reserved.

4.3.7.32. ThermostatProgrammingOperationMode Attribute

This attribute determines the operational state of the thermostat's programming. The thermostat SHALL modify its programming operation when this attribute is modified by a client and update this attribute when its programming operation is modified locally by a user. The thermostat MAY support more than one active *ThermostatProgrammingOperationMode*. For example, the thermostat MAY operate simultaneously in Schedule Programming Mode and Recovery Mode.

Thermostats which contain a schedule MAY use this attribute to control how that schedule is used, even if they do not support the Schedule Configuration feature.

Table 79. ThermostatProgrammingOperationMode Attribute Values

Bit	Name	Description
0	ScheduleActive	Schedule programming mode. This enables any programmed weekly schedule configurations.
1	AutoRecovery	Auto/recovery mode
2	Economy	Economy/EnergyStar mode

When ScheduleActive is not set, the setpoint is altered only by manual up/down changes at the thermostat or remotely, not by internal schedule programming.

NOTE

Modifying the ScheduleActive bit does not clear or delete previous weekly schedule programming configurations.

4.3.7.33. ThermostatRunningState Attribute

This attribute represents the current relay state of the heat, cool, and fan relays.

Table 80. HVAC Relay State Values

Bit	Name	Description
0	Heat	Heat State On
1	Cool	Cool State On
2	Fan	Fan State On
3	HeatStage2	Heat 2 nd Stage State On
4	CoolStage2	Cool 2 nd Stage State On
5	FanStage2	Fan 2 nd Stage State On
6	FanStage3	Fan 3 rd Stage Stage On

Unimplemented outputs SHALL be treated as if they were Off.

4.3.7.34. SetpointChangeSource Attribute

This attribute specifies the source of the current active *OccupiedCoolingSetpoint* or *OccupiedHeatingSetpoint* (i.e., who or what determined the current setpoint).

This attribute enables service providers to determine whether changes to setpoints were initiated due to occupant comfort, scheduled programming or some other source (e.g., electric utility or other service provider). Because automation services MAY initiate frequent setpoint changes, this attribute clearly differentiates the source of setpoint changes made at the thermostat.

Table 81. SetpointChangeSource Values

Value	Name	Conformance	Description
0	Manual	O	Manual, user-initiated setpoint change via the thermostat
1	Schedule	[SCH]	Schedule/internal programming-initiated set-point change
2	External	O	Externally-initiated set-point change (e.g., DRLC cluster command, attribute write)

4.3.7.35. SetpointChangeAmount Attribute

This attribute specifies the delta between the current active *OccupiedCoolingSetpoint* or *OccupiedHeatingSetpoint* and the previous active setpoint. This attribute is meant to accompany the *SetpointChangeSource* attribute; devices implementing *SetpointChangeAmount* SHOULD also implement *SetpointChangeSource*.

The null value indicates that the previous setpoint was unknown.

4.3.7.36. SetpointChangeSourceTimestamp Attribute

This attribute specifies the time in UTC at which the *SetpointChangeSourceAmount* attribute change was recorded.

4.3.7.37. OccupiedSetback Attribute

This attribute specifies the amount that the Thermostat server will allow the [LocalTemperature Value](#) to float above the *OccupiedCooling* setpoint (i.e., *OccupiedCooling* + *OccupiedSetback*) or below the *OccupiedHeating* setpoint (i.e., *OccupiedHeating* – *OccupiedSetback*) before initiating a state change to bring the temperature back to the user's desired setpoint. This attribute is sometimes also referred to as the "span."

The purpose of this attribute is to allow remote configuration of the span between the desired set-

point and the measured temperature to help prevent over-cycling and reduce energy bills, though this may result in lower comfort on the part of some users.

The null value indicates the attribute is unused.

If the Thermostat client attempts to write *OccupiedSetback* to a value greater than *OccupiedSetbackMax*, the Thermostat server SHALL set its *OccupiedSetback* value to *OccupiedSetbackMax* and SHALL send a Write Attribute Response command with a Status Code field enumeration of SUCCESS response.

If the Thermostat client attempts to write *OccupiedSetback* to a value less than *OccupiedSetbackMin*, the Thermostat server SHALL set its *OccupiedSetback* value to *OccupiedSetbackMin* and SHALL send a Write Attribute Response command with a Status Code field enumeration of SUCCESS response.

4.3.7.38. OccupiedSetbackMin Attribute

This attribute specifies the minimum value that the Thermostat server will allow the *OccupiedSetback* attribute to be configured by a user.

The null value indicates the attribute is unused.

4.3.7.39. OccupiedSetbackMax Attribute

This attribute specifies the maximum value that the Thermostat server will allow the *OccupiedSetback* attribute to be configured by a user.

The null value indicates the attribute is unused.

4.3.7.40. UnoccupiedSetback Attribute

This attribute specifies the amount that the Thermostat server will allow the [LocalTemperature Value](#) to float above the UnoccupiedCooling setpoint (i.e., UnoccupiedCooling + UnoccupiedSetback) or below the UnoccupiedHeating setpoint (i.e., UnoccupiedHeating - UnoccupiedSetback) before initiating a state change to bring the temperature back to the user's desired setpoint. This attribute is sometimes also referred to as the "span."

The purpose of this attribute is to allow remote configuration of the span between the desired set-point and the measured temperature to help prevent over-cycling and reduce energy bills, though this may result in lower comfort on the part of some users.

The null value indicates the attribute is unused.

If the Thermostat client attempts to write UnoccupiedSetback to a value greater than UnoccupiedSetbackMax, the Thermostat server SHALL set its UnoccupiedSetback value to UnoccupiedSetbackMax and SHALL send a Write Attribute Response command with a Status Code field enumeration of SUCCESS response.

If the Thermostat client attempts to write UnoccupiedSetback to a value less than UnoccupiedSetbackMin, the Thermostat server SHALL set its UnoccupiedSetback value to UnoccupiedSetbackMin and SHALL send a Write Attribute Response command with a Status Code field enumeration of SUCCESS response.

4.3.7.41. UnoccupiedSetbackMin Attribute

This attribute specifies the minimum value that the Thermostat server will allow the *UnoccupiedSetback* attribute to be configured by a user.

The null value indicates the attribute is unused.

4.3.7.42. UnoccupiedSetbackMax Attribute

This attribute specifies the maximum value that the Thermostat server will allow the *UnoccupiedSetback* attribute to be configured by a user.

The null value indicates the attribute is unused.

4.3.7.43. EmergencyHeatDelta Attribute

This attribute specifies the delta between the *LocalTemperature Value* and the *OccupiedHeatingSetpoint* or *UnoccupiedHeatingSetpoint* attributes at which the Thermostat server will operate in emergency heat mode.

If the difference between *LocalTemperature Value* and *Un/OccupiedHeatingSetpoint* is greater than or equal to the *EmergencyHeatDelta* and the Thermostat server's *SystemMode* attribute is in a heating-related mode, then the Thermostat server SHALL immediately switch to the *SystemMode* attribute value that provides the highest stage of heating (e.g., emergency heat) and continue operating in that running state until the *OccupiedHeatingSetpoint* value is reached. For example:

- *LocalTemperature* = 10.0°C
- *OccupiedHeatingSetpoint* = 16.0°C
- *EmergencyHeatDelta* = 2.0°C

⇒ *OccupiedHeatingSetpoint - LocalTemperature* ≥? *EmergencyHeatDelta*

⇒ 16°C - 10°C ≥? 2°C

⇒ TRUE >>> Thermostat server changes its *SystemMode* to operate in 2nd stage or emergency heat mode

The purpose of this attribute is to provide Thermostat clients the ability to configure rapid heating when a setpoint is of a specified amount greater than the measured temperature. This allows the heated space to be quickly heated to the desired level set by the user.

4.3.7.44. ACType Attribute

This attribute indicates the type of Mini Split *ACType* of Mini Split AC is defined depending on how Cooling and Heating condition is achieved by Mini Split AC.

Table 82. ACType Values

Value	Name	Conformance	Description
0	Unknown	O	Unknown AC Type
1	CoolingFixed	O	Cooling and Fixed Speed
2	HeatPumpFixed	O	Heat Pump and Fixed Speed
3	CoolingInverter	O	Cooling and Inverter
4	HeatPumpInverter	O	Heat Pump and Inverter

4.3.7.45. ACCapacity Attribute

This attribute indicates capacity of Mini Split AC in terms of the format defined by the *ACCapacity-Format* attribute

4.3.7.46. ACRefrigerantType Attribute

This attribute indicates type of refrigerant used within the Mini Split AC.

Table 83. *ACRefrigerantType Values*

Value	Name	Conformance	Description
0	Unknown	O	Unknown Refrigerant Type
1	R22	O	R22 Refrigerant
2	R410a	O	R410a Refrigerant
3	R407c	O	R407c Refrigerant

4.3.7.47. ACCompressorType Attribute

This attribute indicates type of Compressor used within the Mini Split AC.

Table 84. *ACCCompressorType Values*

Value	Name	Conformance	Description
0	Unknown	O	Unknown compressor type
1	T1	O	Max working ambient 43 °C
2	T2	O	Max working ambient 35 °C
3	T3	O	Max working ambient 52 °C

4.3.7.48. ACErrorCode Attribute

This attribute indicates the type of errors encountered within the Mini Split AC. Error values are reported with four bytes values. Each bit within the four bytes indicates the unique error.

Table 85. ACErrorCode Values

Bit	Name	Description
0	CompressorFail	Compressor Failure or Refrigerant Leakage
1	RoomSensorFail	Room Temperature Sensor Failure
2	OutdoorSensorFail	Outdoor Temperature Sensor Failure
3	CoilSensorFail	Indoor Coil Temperature Sensor Failure
4	FanFail	Fan Failure

4.3.7.49. ACLouverPosition Attribute

This attribute indicates the position of Louver on the AC.

Table 86. ACLouverPosition Values

Value	Name	Conformance	Description
1	Closed	O	Fully Closed
2	Open	O	Fully Open
3	Quarter	O	Quarter Open
4	Half	O	Half Open
5	ThreeQuarters	O	Three Quarters Open

4.3.7.50. ACCoilTemperature Attribute

This attribute represents the temperature of the AC coil, as measured locally or remotely (over the network).

4.3.7.51. ACCapacityFormat Attribute

This attribute specifies the format for the *ACCapacity* attribute.

Table 87. ACCapacity Values

Value	Name	Conformance	Description
0	BTUh	O	British Thermal Unit per Hour

4.3.8. Commands

Id	Name	Direction	Response	Access	Conformance
0x00	Set-pointRaiseLower	Client ⇒ Server	Y	O	M
0x01	SetWeeklySchedule	Client ⇒ Server	Y	M	SCH
0x02	GetWeeklySchedule	Client ⇒ Server	GetWeeklyScheduleResponse	O	SCH
0x03	Clear-WeeklySchedule	Client ⇒ Server		M	SCH
0x04	GetRelayStatusLog	Client ⇒ Server	GetRelayStatusLogResponse	O	O
0x00	GetWeeklyScheduleResponse	Server ⇒ Client	N		SCH
0x01	GetRelayStatusLogResponse	Server ⇒ Client	N		O

4.3.8.1. Setpoint Raise/Lower Command

Upon receipt, the attributes for the indicated setpoint(s) SHALL have the amount specified in the Amount field added to them. If the resulting value is outside the limits imposed by MinCoolSetpointLimit, MaxCoolSetpointLimit, MinHeatSetpointLimit and MaxHeatSetpointLimit, the value is clamped to those limits. This is not considered an error condition.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Mode	enum8	desc			M
1	Amount	int8	all			M

4.3.8.2. Mode Field

The mode field SHALL be set to one of the values below. It specifies which setpoints are to be adjusted.

Table 88. Mode Field Values for Setpoint Raise/Lower Command

Value	Name	Conformance	Description
0	Heat	HEAT	Adjust Heat Setpoint
1	Cool	COOL	Adjust Cool Setpoint

Value	Name	Conformance	Description
2	Both	HEAT COOL	Adjust Heat Setpoint and Cool Setpoint

4.3.8.2.1. Heat

If the server does not support the HEAT feature then it SHALL respond with INVALID_ARGUMENT. If the server supports the AUTO feature and the resulting setpoint would be invalid solely due to MinSetpointDeadBand then the Cooling setpoint SHALL be increased sufficiently to maintain the deadband.

4.3.8.2.2. Cool

If the server does not support the COOL feature then it SHALL respond with INVALID_ARGUMENT. If the server supports the AUTO feature and the resulting setpoint would be invalid solely due to MinSetpointDeadBand then the Heating setpoint SHALL be decreased sufficiently to maintain the deadband.

4.3.8.2.3. Both

The client MAY indicate Both regardless of the server feature support. The server SHALL only adjust the setpoint that it supports and not respond with an error.

4.3.8.3. Amount Field

This field indicates the amount (possibly negative) that should be added to the setpoint(s), in steps of 0.1°C.

4.3.8.4. Set Weekly Schedule Command

Upon receipt, the weekly schedule for updating set points SHALL be stored in the thermostat and SHOULD begin at the time of receipt. A status code SHALL be sent in response.

When a command is received that requires a total number of transitions greater than the device supports, the status of the response SHALL be INSUFFICIENT_SPACE.

When any of the set points sent in the sequence is out of range (AbsMin/MaxSetPointLimit), or when the Mode for Sequence field includes a mode not supported by the device, the status of the response SHALL be CONSTRAINT_ERROR and no set points from the entire sequence SHOULD be used.

When an overlapping transition is detected, the status of the response SHALL be FAILURE.

When a device which does not support multiple days in a command receives a command with more than one bit set in the DayOfWeekforSequence field, or when a device which does not support multiple modes in a command receives a command with more than one bit set in the ModeForSequence field, or when the contents of the Transitions field does not agree with NumberOfTransitionsForSequence, DayOfWeekforSequence or ModeForSequence, the status of the response SHALL be INVALID_COMMAND.

When the transitions could be added successfully, the status of the response SHALL be SUCCESS.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	NumberOf-Transitions-ForSequence	uint8	all			M
1	DayOfWeek-forSequence	map8	desc			M
2	ModeForSequence	map8	desc			M
3	Transitions	list[ThermostatScheduleTransition]	max 10			M

The set weekly schedule command is used to update the thermostat weekly set point schedule from a management system. If the thermostat already has a weekly set point schedule programmed, then it SHOULD replace each daily set point set as it receives the updates from the management system. For example, if the thermostat has 4 set points for every day of the week and is sent a Set Weekly Schedule command with one set point for Saturday then the thermostat SHOULD remove all 4 set points for Saturday and replace those with the updated set point but leave all other days unchanged. If the schedule is larger than what fits in one frame or contains more than 10 transitions, the schedule SHALL then be sent using multiple Set Weekly Schedule Commands.

Each Set Weekly Schedule Command has 3 header bytes – Number of Transitions for Sequence, Day of Week for Sequence, and Mode for Sequence. The application SHALL decode the payload according to what has specified in the 3 header bytes.

4.3.8.5. Number of Transitions for Sequence

The Number of Transitions for Sequence field indicates how many individual transitions to expect for this sequence of commands. If a device supports more than 10 transitions in its schedule they can send this by sending more than 1 “Set Weekly Schedule” command, each containing the separate information that the device needs to set.

4.3.8.6. Day of Week for Sequence

This field represents the day of the week at which all the transitions within the payload of the command SHOULD be associated to. This field is a bitmap and therefore the associated set point could overlap onto multiple days (you could set one transition time for all “week days” or whatever combination of days the implementation requests).

Table 89. Day Of Week for Sequence Values

Bit	Name	Description
0	Sunday	Sunday
1	Monday	Monday
2	Tuesday	Tuesday
3	Wednesday	Wednesday
4	Thursday	Thursday
5	Friday	Friday
6	Saturday	Saturday
7	Away	Away or Vacation

Each set point transition will begin with the day of week for this transition. There can be up to 10 transitions for each command.

4.3.8.7. Mode for Sequence

This field determines how the application SHALL decode the Set Point Fields of each transition in the Transitions list.

Table 90. Mode for Sequence Values

Bit	Name	Description
0	HeatSetpointPresent	HeatSetpoint Field Present in Payload
1	CoolSetpointPresent	CoolSetpoint Field Present in Payload

If the HeatSetpointPresent bit is On, the HeatSetpoint field SHALL be included in **every** entry of the Transitions list.

If the HeatSetpointPresent bit is Off, the HeatSetpoint field SHALL NOT be included in **any** entry of the Transitions list.

If the CoolSetpointPresent bit is On, the CoolSetpoint field SHALL be included in **every** entry of the Transitions list.

If the CoolSetpointPresent bit is Off, the CoolSetpoint field SHALL NOT be included in **any** entry of the Transitions list.

At least one of the bits in the Mode For Sequence byte SHALL be on.

Both bits must be respected, even if the HEAT or COOL feature is not supported, to ensure the command is decoded and handled correctly.

4.3.8.8. Transitions Field

This field contains the list of setpoint transitions used to update the specified daily schedules

4.3.8.9. Get Weekly Schedule

Upon receipt, the unit SHOULD send in return the Get Weekly Schedule Response command. The Days to Return and Mode to Return fields are defined as bitmask for the flexibility to support multiple days and multiple modes within one command. If thermostat cannot handle incoming command with multiple days and/or multiple modes within one command, it SHALL send default response of INVALID_COMMAND in return.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	DaysToReturn	map8	desc			M
1	ModeToReturn	map8	desc			M

4.3.8.9.1. Days To Return

This field indicates the number of days the client would like to return the set point values for and could be any combination of single days or the entire week. This field has the same format as [Day Of Week for Sequence Values](#).

4.3.8.9.2. Mode To Return

This field indicates the mode the client would like to return the set point values for and could be any combination of heat only, cool only or heat&cool. This field has the same format as [Mode for Sequence Values](#).

4.3.8.10. Clear Weekly Schedule

The Clear Weekly Schedule command is used to clear the weekly schedule. The Clear weekly schedule has no payload.

Upon receipt, all transitions currently stored SHALL be cleared and a default response of SUCCESS SHALL be sent in response. There are no error responses to this command.

4.3.8.11. Get Relay Status Log

The Get Relay Status Log command is used to query the thermostat internal relay status log. This command has no payload.

Upon receipt, the unit SHALL respond with Relay Status Log command if the relay status log feature is supported on the unit.

The log storing order is First in First Out (FIFO) when the log is generated and stored into the Queue.

The first record in the log (i.e., the oldest) one, is the first to be replaced when there is a new record and there is no more space in the log. Thus, the newest record will overwrite the oldest one if there is no space left.

The log storing order is Last In First Out (LIFO) when the log is being retrieved from the Queue by a client device.

Once the "Get Relay Status Log Response" frame is sent by the Server, the "Unread Entries" attribute SHOULD be decremented to indicate the number of unread records that remain in the queue.

If the "Unread Entries" attribute reaches zero and the Client sends a new "Get Relay Status Log Request", the Server MAY send one of the following items as a response:

- i. resend the last Get Relay Status Log Response

or

generate new log record at the time of request and send Get Relay Status Log Response with the new data

For both cases, the "Unread Entries" attribute will remain zero.

4.3.8.12. Get Weekly Schedule Response

This command has the same payload format as the Set Weekly Schedule. Please refer to the payload detail in [Set Weekly Schedule Command](#).

4.3.8.13. Get Relay Status Log Response

This command is sent from the thermostat cluster server in response to the Get Relay Status Log. After the Relay Status Entry is sent over the air to the requesting client, the specific entry will be cleared from the thermostat internal log.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	TimeOfDay	uint16	0 to 1439			M
1	RelayStatus	map8	desc			M
2	LocalTemperature	temperature	all	X		M
3	HumidityInPercentage	uint8	0% to 100%	X		M
4	SetPoint	temperature	all			M
5	UnreadEntries	uint16	all			M

4.3.8.13.1. Time of Day Field

Represents the sample time of the day, in minutes since midnight, when the relay status was captured for this associated log entry. For example, 6am will be represented by 360 minutes since midnight and 11:30pm will be represented by 1410 minutes since midnight.

4.3.8.13.2. Relay Status Field

Presents the relay status for thermostat when the log is captured. Each bit represents one relay used by the thermostat. If the bit is on, the associated relay is on and active. Each thermostat manufacturer can create its own mapping between the bitmask and the associated relay.

4.3.8.13.3. Local Temperature Field

Presents the [LocalTemperature Value](#) when the log is captured. The null value indicates that Local-Temperature was invalid or unavailable.

4.3.8.13.4. Humidity Field

This field presents the humidity as a percentage when the log was captured. The null value indicates that the humidity value was invalid or unknown.

4.3.8.13.5. Setpoint Field

Presents the target setpoint temperature when the log is captured.

4.3.8.13.6. Unread Entries Field

This field presents the number of unread entries within the thermostat internal log system.

4.3.9. Data Types

4.3.9.1. Temperature ([temperature type](#))

This type, derived from int16, represents a temperature on the Celsius scale with a resolution of 0.01°C.

- $value = (\text{temperature in } ^\circ\text{C}) \times 100$

- $-4^\circ\text{C} \Rightarrow -400$
- $123.45^\circ\text{C} \Rightarrow 12345$

The range is constrained by absolute zero: -273.15°C to 327.67°C.

4.3.9.2. Temperature Difference ([temp-diff type](#))

This type, derived from int16, represents a temperature difference with a resolution of 0.01°C.

- $value = (\text{temperature in } ^\circ\text{C}) \times 100$

- $-4^\circ\text{C} \Rightarrow -400$
- $123.45^\circ\text{C} \Rightarrow 12345$

The full (non-null) range of -327.67°C to 327.67°C may be used.

4.3.9.3. Signed Temperature (°C x 10) (**temp-s8** type)

This type, derived from int8, represents a temperature from -12.7°C to 12.7°C with a resolution of 0.1°C.

- $value = (\text{temperature in } ^\circ\text{C}) \times 10$

- $-4^\circ\text{C} \Rightarrow -40$
- $12.3^\circ\text{C} \Rightarrow 123$

This type is employed where compactness of representation is important and where the resolution and range are still satisfactory.

4.3.9.4. Unsigned Temperature (°C x 10) (**temp-u8** type)

This type, derived from uint8, represents a temperature from 0°C to 25.5°C with a resolution of 0.1°C.

- $value = (\text{temperature in } ^\circ\text{C}) \times 10$

- $4^\circ\text{C} \Rightarrow 40$
- $12.3^\circ\text{C} \Rightarrow 123$

This type is employed where compactness of representation is important and where the resolution and range are still satisfactory.

4.3.9.5. ThermostatScheduleTransition

This represents a single transition in a Thermostat schedule

Id	Name	Type	Constraint	Quality	Access	Default	Conformance
0	Transi-tionTime	uint16	0 to 1439		RW		M
1	HeatSet-point	tempera-ture	all		RW		M
2	CoolSet-point	tempera-ture	all		RW		M

4.3.9.5.1. TransitionTime

This field represents the start time of the schedule transition during the associated day. The time will be represented by a 16 bits unsigned integer to designate the minutes since midnight. For example, 6am will be represented by 360 minutes since midnight and 11:30pm will be represented by 1410 minutes since midnight.

4.3.9.6. HeatSetpoint

This field represents the heat setpoint to be applied at this associated transition start time.

4.3.9.7. CoolSetpoint

This field represents the cool setpoint to be applied at this associated transition start time.

4.4. Fan Control

4.4.1. Introduction

This cluster specifies an interface to control the speed of a fan.

NOTE Support for Fan Control cluster is provisional.

4.4.2. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	global mandatory ClusterRevision attribute added
2	New data model format and notation; Percent, speed and motion settings; General cleanup

4.4.3. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	FAN	Type 1 (client to server)

4.4.4. Cluster Identifiers

Identifier	Name
0x0202	Fan Control

4.4.5. Features

This cluster SHALL support the Feature Map global attribute with these bits defined.

Bit	Code	Name	Description
0	SPD	Multi-Speed	1-100 speeds
1	AUT	Auto	Automatic mode supported for fan speed

Bit	Code	Name	Description
2	RCK	Rocking	Rocking movement supported
3	WND	Wind	Wind emulation supported

4.4.5.1. Multi-Speed Feature

Legacy Fan Control cluster revision 0-1 defined 3 speeds (low, medium and high) plus automatic speed control but left it up to the implementer to decide what was supported. Therefore, it is assumed that legacy client implementations are capable of determining, from the server, the number of speeds supported between 1, 2, or 3, and whether automatic speed control is supported.

The Multi-Speed feature includes new attributes that support a running fan speed value from 1 to a maximum of 100. See [Section 4.4.6.6.1](#) for more details.

4.4.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	FanMode	enum8	0 to 6	N	0	RW VO	M
0x0001	FanMode-Sequence	enum8	0 to 5	N	MS	R[W] VO	M
0x0002	PercentSetting	uint8	0 to 100	X	0	RW VO	M
0x0003	PercentCurrent	uint8	0 to 100		desc	R V	M
0x0004	SpeedMax	uint8	1 to 100	F	MS	R V	SPD
0x0005	SpeedSetting	uint8	0 to Speed-Max	X	0	RW VO	SPD
0x0006	SpeedCurrent	uint8	0 to Speed-Max	P	desc	R V	SPD
0x0007	RockSupport	map8	desc	F	0	R V	RCK
0x0008	RockSetting	map8	desc	P	0	RW VO	RCK
0x0009	WindSupport	map8	desc	F	0	R V	WND
0x000a	WindSetting	map8	desc	P	0	RW VO	WND

4.4.6.1. FanMode Attribute

This attribute SHALL indicate the current speed mode of the fan. This attribute MAY be written by the client to indicate a new speed mode of the fan. This attribute SHALL be set to one of the values in the table below.

Value	Name	Conformance
0	Off	M
1	Low	desc
2	Medium	desc
3	High	desc
4	On	D
5	Auto	AUT
6	Smart	D

4.4.6.1.1. Off

Setting the attribute value to Off SHALL set the values of these attributes to 0 (zero):

- [PercentSetting](#)
- [PercentCurrent](#)
- [SpeedSetting](#) (if present)
- [SpeedCurrent](#) (if present)

4.4.6.1.2. Low, Medium, High or Unsupported

If the fan only supports 1 speed then:

- only the High attribute value SHALL be supported
- [SpeedMax](#) attribute, if present, SHALL be 1

If the fan only supports 2 speeds then only the Low and High attribute values SHALL be supported.

If a client attempts to write an unsupported value (such as On), the FanMode attribute SHALL be set to High.

If the value is High, Medium, or Low the server SHALL set these percent speed attributes to a single value in the corresponding range as defined in [the percent rules](#):

- [PercentSetting](#)
- [PercentCurrent](#)

If the value is High, Medium, or Low the server SHALL set these speed attributes to a single value in the corresponding range as defined in [Speed Rules](#):

- [SpeedSetting](#) (if present)

- [SpeedCurrent](#) (if present)

4.4.6.1.3. Auto

Setting the attribute value to Auto SHALL set the values of these attributes to null:

- [PercentSetting](#)
- [SpeedSetting](#) (if present)

These attributes SHALL indicate the current state of the fan while this attribute value is Auto:

- [PercentCurrent](#)
- [SpeedCurrent](#) (if present)

4.4.6.2. FanModeSequence Attribute

This indicates the fan speed ranges that SHALL be supported.

Value	Name	Conformance
0	Off/Low/Med/High	O.a
1	Off/Low/High	O.a
2	Off/Low/Med/High/Auto	[AUT].a
3	Off/Low/High/Auto	[AUT].a
4	Off/On/Auto	[AUT].a
5	Off/On	O.a

4.4.6.3. PercentSetting Attribute

This attribute SHALL indicate the speed setting for the fan. This attribute MAY be written by the client to indicate a new fan speed. If the client writes null to this attribute, the attribute value SHALL NOT change. If this is set to 0, the server SHALL set the FanMode attribute value to Off.

4.4.6.3.1. Percent Rules

It is up to the server implementation to map between ranges of the PercentSetting attribute and FanMode attribute enumerated values. Percent values are split into ranges, each range corresponding to a supported FanMode attribute value. Percent ranges SHALL NOT overlap. All percent values in the High speed range SHALL be higher than all percent values in the Medium and Low speed ranges, if supported. All percent values in the Medium speed range SHALL be higher than all percent values in the Low speed range. If the client sets the FanMode attribute to Low, Medium or High, the server SHALL set the PercentSetting attribute to a value within the corresponding range. If the client sets the PercentSetting attribute, the server SHALL set the FanMode attribute to Low, Medium or High, based on the percent value being in the corresponding range.

If the [Section 4.4.5.1](#) feature is supported, the calculation of [SpeedSetting](#) or [SpeedCurrent](#) (speed) from a percent value change for PercentSetting or PercentCurrent respectively (percent) SHALL hold true:

- speed = ceil(SpeedMax * (percent * 0.01))

For example: If the SpeedMax attribute is 42 (42 speed fan) and PercentSetting is changed to 25, then [SpeedSetting](#) and [SpeedCurrent](#) become 11 (rounding up 10.5).

4.4.6.4. PercentCurrent Attribute

This attribute SHALL indicate the actual currently operating fan speed, or zero to indicate that the fan is off. See [Section 4.4.6.3.1](#) for more details.

4.4.6.5. SpeedMax Attribute

This attribute SHALL indicate that the fan has one speed (value of 1) or the maximum speed, if the fan is capable of multiple speeds.

4.4.6.6. SpeedSetting Attribute

This attribute SHALL indicate the speed setting for the fan. This attribute MAY be written by the client to indicate a new fan speed. If the client writes null to this attribute, the attribute value SHALL NOT change. If this is set to 0, the server SHALL set the FanMode attribute value to Off. Please see the [Section 4.4.6.6.1](#) for details on other values.

4.4.6.6.1. Speed Rules

It is up to the server implementation to map between ranges of the SpeedSetting attribute and FanMode attribute enumerated values. Speed values are split into ranges, each range corresponding to a FanMode attribute value. Speed ranges SHALL NOT overlap. All speed values in the High speed range SHALL be higher than all speed values in the Medium and Low speed ranges, if supported. All speed values in the Medium speed range SHALL be higher than all speed values in the Low speed range. If the client sets the FanMode attribute to Low, Medium or High, the server SHALL set the SpeedSetting attribute to a value within the corresponding range. If the client sets the SpeedSetting attribute, the server SHALL set the FanMode attribute to Low, Medium or High, based on the speed value being in the corresponding range.

This calculation for the value of [PercentSetting](#) or [PercentCurrent](#) (percent) from a speed value change for SpeedSetting or SpeedCurrent respectively (speed) SHALL hold true:

- percent = floor(speed/SpeedMax * 100)

For example: If the SpeedMax attribute is 42 (42 speed fan) and SpeedSetting attribute is changed to 11, then [PercentSetting](#) and [PercentCurrent](#) become 26.

4.4.6.7. SpeedCurrent Attribute

This attribute SHALL indicate the actual currently operating fan speed, or zero to indicate that the fan is off.

4.4.6.8. RockSupport Attribute

This attribute is a bitmap that indicates what rocking motions the server supports. The bitmap is shown in the table below.

Bit	Name
0	RockLeftRight
1	RockUpDown
2	RockRound

4.4.6.9. RockSetting Attribute

This attribute is a bitmap that indicates the current active fan rocking motion settings. Each bit SHALL only be set to 1, if the corresponding bit in the RockSupport attribute is set to 1, otherwise a status code of CONSTRAINT_ERROR SHALL be returned.

If a combination of supported bits is set by the client, and the server does not support the combination, the lowest supported single bit in the combination SHALL be set and active, and all other bits SHALL indicate zero.

For example: If RockUpDown and RockRound are both set, but this combination is not possible, then only RockUpDown becomes active.

The bitmap is shown in the table below.

Bit	Name
0	RockLeftRight
1	RockUpDown
2	RockRound

4.4.6.10. WindSupport Attribute

This attribute is a bitmap that indicates what wind modes the server supports. At least one wind mode bit SHALL be set. The bitmap is shown in the table below.

Bit	Name
0	Sleep Wind
1	Natural Wind

4.4.6.10.1. Sleep Wind

The fan speed, based on current settings, SHALL gradually slow down to a final minimum speed. For this process, the sequence, speeds and duration are MS.

4.4.6.10.2. Natural Wind

The fan speed SHALL vary to emulate natural wind. For this setting, the sequence, speeds and duration are MS.

4.4.6.11. WindSetting Attribute

This attribute is a bitmap that indicates the current active fan wind feature settings. Each bit SHALL only be set to 1, if the corresponding bit in the WindSupport attribute is set to 1, otherwise a status code of CONSTRAINT_ERROR SHALL be returned.

If a combination of supported bits is set by the client, and the server does not support the combination, the lowest supported single bit in the combination SHALL be set and active, and all other bits SHALL indicate zero.

For example: If Sleep Wind and Natural Wind are set, but this combination is not possible, then only Sleep Wind becomes active.

The bitmap is shown in the table below.

Bit	Name
0	Sleep Wind
1	Natural Wind

4.5. Thermostat User Interface Configuration

This cluster provides an interface to allow configuration of the user interface for a thermostat, or a thermostat controller device, that supports a keypad and LCD screen.

4.5.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	global mandatory ClusterRevision attribute added
2	New data model format and notation, added "Conversion of Temperature Values for Display" section

4.5.2. Classification

Hierarchy	Role	Context	PICS Code	Primary Transaction
Base	Application	Endpoint	TSUIC	Type 1 (client to server)

4.5.3. Cluster Identifiers

Identifier	Name
0x0204	Thermostat User Interface Configuration

4.5.4. Conversion of Temperature Values for Display

When converting temperature values for display manufacturers SHOULD ensure that calculations round to the nearest representable value. Particular care is needed when using integer arithmetic.

For example, assuming a display resolution of 0.5:

Attribute value	Temperature		Display as	
	°C	°F	°C	°F
1965	19.65	67.37	19.5	67.5
-545	-5.45	22.19	-5.5	22
-1823	-18.23	-0.81	-18	-1

4.5.4.1. Sample Conversion Code

Sample code provided to ensure consistent Fahrenheit to Celsius and vice-versa conversion between devices and across vendors.

For degF: the value is a int8u representing 2x temperature value in Fahrenheit (to get 0.5 resolution).

For degC: the value is a int16s representing Celsius in 0.01 resolution as expected by the ZCL format.

```
/*
 * Function : translateZclTemp()
 * Description : Converts the temperature setpoints in ZCL
 * to the half degF format.
 * The half degF format is 8-bit unsigned,
 * and represents 2x temperature value in
 * Fahrenheit (to get 0.5 resolution).
 * The format used in ZCL is 16-bit signed
 * in Celsius and multiplied by 100
 * to get 0.01 resolution.
 * e.g. 2500 (25.00 deg C) ---> 0x9A (77 deg F)
 * Input Para : Temperature in ZCL (degC) format
 * Output Para: Temperature in half DegF format
 */
int8u translateZclTemp(int16s temperature)
{
    int32s x = temperature;
```

```

// rearrangement of
// = (x * (9/5) / 100 + 32) * 2;
// the added 250 is for proper rounding.
// a rounding technique that only works
// with positive numbers

return (int8u) ((x*9*2 + 250)/ (5*100) + 64);
}

/*
* Function : translateDegFTemp
* Description : Converts the temperature in DegF
* protocol to the format
* expected by the cluster attribute
* Measured Value in the
* Temperature Measurement
* Information Attribute Set.
* The half deg F format is 8-bit
* unsigned, and represents
* 2x temperature value in
* Fahrenheit (to get 0.5 resolution).
* The format expected by cluster
* is 16-bit signed in Celsius and
* multiplied by 100 to get
* 0.01 resolution.
* e.g. 0x9A (77 deg F) ---> 2500 (25.00 deg C)
* Input Para : temperature in DegF format
* Output Para: temperature in ZCL format
*/
int16s translateDegFTemp(int8u temperature)
{
    int32s x = temperature;

    // rearrangement of
    // = 100 * (x/2 - 32) * 5/9
    // *1000 (should be 100), +90, then /10,
    // is for rounding.

    return (int16s) (((x - 64)*5*1000 + 90) / (10*2*9));
}

```

4.5.5. Attributes

Table 91. Thermostat User Interface Configuration Cluster Attributes

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	TemperatureDisplayMode	enum8	desc		0 (Celsius)	RW VO	M

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0001	Keypad-Lockout	enum8	desc		0 (no lock-out)	RW VM	M
0x0002	ScheduleProgrammingVisibility	enum8	desc		0	RW VM	O

4.5.5.1. TemperatureDisplayMode Attribute

The TemperatureDisplayMode attribute specifies the units of the temperature displayed on the thermostat screen.

Table 92. DisplayMode Attribute Values

Value	Name	Conformance	Description
0	Celsius	M	Temperature displayed in °C
1	Fahrenheit	M	Temperature displayed in °F

4.5.5.2. KeypadLockout Attribute

The KeypadLockout attribute specifies the level of functionality that is available to the user via the keypad.

Table 93. KeypadLockout Attribute Values

Value	Name	Conformance	Description
0	NoLockout	M	All functionality available to the user
1	Lockout1	M	Level 1 reduced functionality
2	Lockout2	M	Level 2 reduced functionality
3	Lockout3	M	Level 3 reduced functionality
4	Lockout4	M	Level 4 reduced functionality
5	Lockout5	M	Least functionality available to the user

The interpretation of the various levels is device-dependent.

4.5.5.3. ScheduleProgrammingVisibility Attribute

The ScheduleProgrammingVisibility attribute is used to hide the weekly schedule programming functionality or menu on a thermostat from a user to prevent local user programming of the weekly schedule. The schedule programming MAY still be performed via a remote interface, and the thermostat MAY operate in schedule programming mode.

This attribute is designed to prevent local tampering with or disabling of schedules that MAY have been programmed by users or service providers via a more capable remote interface. The programming schedule SHALL continue to run even though it is not visible to the user locally at the thermostat.

Table 94. ScheduleProgrammingVisibility Attribute Values

Value	Name	Conformance	Description
0	ScheduleProgrammingPermitted	M	Local schedule programming functionality is enabled at the thermostat
1	ScheduleProgrammingDenied	M	Local schedule programming functionality is disabled at the thermostat

4.5.6. Commands

No cluster specific commands are generated or received by the server.

Chapter 5. Closures

The Cluster Library is made of individual chapters such as this one. References between chapters are made using a X.Y notation where X is the chapter and Y is the sub-section within that chapter.

5.1. General Description

5.1.1. Introduction

The clusters specified in this document are for use typically in applications involving closures (e.g., shades, windows, doors), but MAY be used in any application domain.

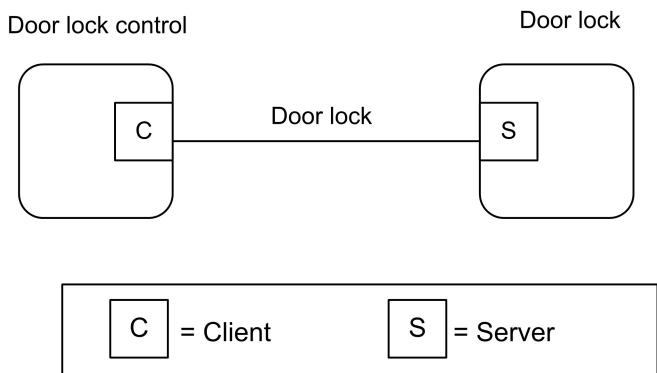
5.1.2. Cluster List

This section lists the clusters specified in this document, and gives examples of typical usage for the purpose of clarification.

The clusters defined in this document are listed in [Table 95](#).

Table 95. Clusters Specified in the Closures Functional Domain

Cluster ID	Cluster Name	Description
0x0101	Door Lock	An interface to a generic way to secure a door
0x0102	Window Covering	Commands and attributes for controlling a window covering



Note: Device names are examples for illustration purposes only

Figure 14. Typical Usage of the Closures Clusters

5.2. Door Lock

5.2.1. Overview

The door lock cluster provides an interface to a generic way to secure a door. The physical object that provides the locking functionality is abstracted from the cluster. The cluster has a small list of mandatory attributes and functions and a list of optional features.

5.2.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	mandatory global ClusterRevision attribute added; CCB 1811 1812 1821
2	CCB 2430
3	CCB 2629 2630
4	All Hubs changes and added feature map
5	
6	New data model format and notation. Added User features. General cleanup of functionality

5.2.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	DRLK

5.2.1.3. Cluster Identifiers

Identifier	Name
0x0101	Door Lock

5.2.2. Features

This cluster SHALL support the Feature Map global attribute with these bits defined.

Bit	Code	Feature	Conformance	Description
0	PIN	PIN Credential	O	Lock supports PIN credentials (via keypad, or over-the-air)
1	RID	RFID Credential	O	Lock supports RFID credentials
2	FGP	Finger Credentials	P, O	Lock supports finger related credentials (fingerprint, finger vein)

Bit	Code	Feature	Conformance	Description
3	LOG	Logging	O	Lock supports local/on-lock logging when Events are not supported
4	WDSCH	Week Day Access Schedules	O	Lock supports week day user access schedules
5	DPS	Door Position Sensor	O	Lock supports a door position sensor that indicates door's state
6	FACE	Face Credentials	P, O	Lock supports face related credentials (face, iris, retina)
7	COTA	Credential Over-the-Air Access	O	PIN codes over-the-air supported for lock/unlock operations
8	USR	User	[PIN RID FGP FACE]	Lock supports the user commands and database
9	NOT	Notification	O	Operation and Programming Notifications
10	YDSCH	Year Day Access Schedules	O	Lock supports year day user access schedules
11	HDSCH	Holiday Schedules	O	Lock supports holiday schedules

5.2.2.1. PIN Credential Feature

If the User Feature is also supported then any PIN Code stored in the lock SHALL be associated with a User.

A lock MAY support multiple credential types so if the User feature is supported the UserType, UserStatus and Schedules are all associated with a User index and not directly with a PIN index. A User index may have several credentials associated with it.

5.2.2.2. RFID Credential Feature

If the User Feature is also supported then any RFID credential stored in the lock SHALL be associated with a User.

A lock MAY support multiple credential types so if the User feature is supported the UserType, UserStatus and Schedules are all associated with a User index and not directly with a RFID index. A User Index may have several credentials associated with it.

5.2.2.3. Finger Credentials Feature

Currently the cluster only defines the metadata format for notifications when a fingerprint/ finger vein credential is used to access the lock and doesn't describe how to create fingerprint/finger vein credentials. If the Users feature is also supported then the User that a fingerprint/finger vein is associated with can also have its UserType, UserStatus and Schedule modified.

A lock MAY support multiple credential types so if the User feature is supported the UserType, UserStatus and Schedules are all associated with a User index and not directly with a Finger index. A User Index may have several credentials associated with it.

5.2.2.4. Logging Feature

If Events are not supported the logging feature SHALL replace the Event reporting structure. If Events are supported the logging feature SHALL NOT be supported.

5.2.2.5. Week Day Access Schedules Feature

If the User feature is supported then Week Day Schedules are applied to a User and not a credential.

Week Day Schedules are used to restrict access to a specified time window on certain days of the week. The schedule is repeated each week. When a schedule is cleared this clears the access restrictions and grants unrestricted access to the user. The lock MAY automatically adjust the UserType when a schedule is created or cleared.

5.2.2.6. Door Position Sensor Feature

If this feature is supported this indicates that the lock has the ability to determine the position of the door which is separate from the state of the lock.

5.2.2.7. Face Credentials Feature

Currently the cluster only defines the metadata format for notifications when a face recognition, iris, or retina credential is used to access the lock and doesn't describe how to create face recognition, iris, or retina credentials. If the Users feature is also supported then the User that a face recognition, iris, or retina credential is associated with can also have its UserType, UserStatus and Schedule modified.

A lock MAY support multiple credential types so if the User feature is supported the UserType, UserStatus and Schedules are all associated with a User and not directly with a credential.

5.2.2.8. Credential Over-the-Air Access Feature

If this feature is supported then the lock supports the ability to verify a credential provided in a lock/unlock command. Currently the cluster only supports providing the PIN credential to the lock/unlock commands. If this feature is supported then the PIN Credential feature SHALL also be

supported.

5.2.2.9. User Feature

If the User Feature is supported then a lock employs a User database. A User within the User database is used to associate credentials and schedules to single user record within the lock. This also means the UserType and UserStatus fields are associated with a User and not a credential.

5.2.2.10. Notification Feature

This is a feature used before support of events. This feature supports notification commands and masks used to filter these notifications.

5.2.2.11. Year Day Access Schedules Feature

If the User feature is supported then Year Day Schedules are applied to a User and not a credential.

Year Day Schedules are used to restrict access to a specified date and time window. When a schedule is cleared this clears the access restrictions and grants unrestricted access to the user. The lock MAY automatically adjust the UserType when a schedule is created or cleared.

5.2.2.12. Holiday Schedules Feature

This feature is used to setup Holiday Schedule in the lock device. A Holiday Schedule sets a start and stop end date/time for the lock to use the specified operating mode set by the Holiday Schedule.

5.2.2.12.1. Recommended steps for creating a new User

It is RECOMMENDED that the Administrator query the door lock for what users already exist in its database to find an available UserIndex for creating a new User (see [Get User Command](#)).

1. Use [Set User Command](#) with an available UserIndex to set the user record fields as applicable.
2. Use [Set Credential Command](#) with same UserIndex to add one or more credentials as applicable.
3. Use [Set Week Day Schedule Command](#) or [Set Year Day Schedule Command](#) with same UserIndex to add one or more schedule restrictions as applicable.

5.2.3. Attributes

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	LockState	enum8	desc	X P S		R V	M
0x0001	LockType	enum8	desc			R V	M
0x0002	ActuatorEnabled	bool	all			R V	M
0x0003	DoorState	enum8	desc	X P		R V	DPS

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0004	DoorOpenEvents	uint32	all			RW VM	[DPS]
0x0005	Door-ClosedEvents	uint32	all			RW VM	[DPS]
0x0006	OpenPeriod	uint16	all			RW VM	[DPS]
0x0010	NumberOfLogRecordsSupported	uint16	all	F	0	R V	LOG
0x0011	NumberOfTotalUsersSupported	uint16	all	F	0	R V	USR
0x0012	NumberOfPINUsersSupported	uint16	all	F	0	R V	PIN
0x0013	NumberOfRFIDUsersSupported	uint16	all	F	0	R V	RID
0x0014	NumberOfWeek-DaySchedulesSupportedPerUser	uint8	all	F	0	R V	WDSCH
0x0015	NumberOfYear-DaySchedulesSupportedPerUser	uint8	all	F	0	R V	YDSCH
0x0016	NumberOfHolidaySchedulesSupported	uint8	all	F	0	R V	HDSCH

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0017	MaxPIN-Code-Length	uint8	all	F	MS	R V	PIN
0x0018	MinPIN-Code-Length	uint8	all	F	MS	R V	PIN
0x0019	MaxRFID-Code-Length	uint8	all	F	MS	R V	RID
0x001a	MinRFID-Code-Length	uint8	all	F	MS	R V	RID
0x001b	CredentialRulesSupported	map8	all	F	1	R V	USR
0x001c	NumberOfCredentialsSupportedPerUser	uint8	all	F	0	R V	USR
0x0020	EnableLogging	bool	all	P	0	R[W] VA	LOG
0x0021	Language	string	max 3	P	MS	R[W] VM	O
0x0022	LEDSettings	uint8	desc	P	0	R[W] VM	O
0x0023	AutoRe-lockTime	uint32	all	P	MS	R[W] VM	O
0x0024	SoundVolume	uint8	desc	P	0	R[W] VM	O
0x0025	Operating-Mode	enum8	desc	P	0	R[W] VM	M
0x0026	SupportedOperatingModes	map16	all	F	0xFFFF	R V	M
0x0027	Default-ConfigurationRegister	map16	all	P	0	R V	O

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0028	EnableLocalProgramming	bool	all	P	1	R[W] VA	O
0x0029	EnableOneTouchLocking	bool	all	P	0	RW VM	O
0x002a	EnableInsideStatusLED	bool	all	P	0	RW VM	O
0x002b	EnablePrivacyModeButton	bool	all	P	0	RW VM	O
0x002c	LocalProgrammingFeatures	map8	all	P	0	R[W] VA	O
0x0030	WrongCodeEntryLimit	uint8	1 to 255	P	MS	R[W] VA	PIN RID
0x0031	UserCodeTemporaryDisableTime	uint8	1 to 255	P	MS	R[W] VA	PIN RID
0x0032	SendPINOverTheAir	bool	all	P	0	R[W] VA	[PIN]
0x0033	RequirePINforRemoteOperation	bool	all	P	0	R[W] VA	COTA & PIN
0x0034	SecurityLevel				0		D
0x0035	ExpiringUserTimeout	uint16	1 to 2880	P	MS	R[W] VA	[USR]
0x0040	Alarm-Mask	map16	all	P	0xFFFF	RW VA	O

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0041	Keypad-OperationEvent-Mask	map16	all	P	0xFFFF	RW VA	[NOT & PIN]
0x0042	Remote-OperationEvent-Mask	map16	all	P	0xFFFF	RW VA	[NOT]
0x0043	Manual-OperationEvent-Mask	map16	all	P	0xFFFF	RW VA	[NOT]
0x0044	RFIDOperation-Event-Mask	map16	all	P	0xFFFF	RW VA	[NOT & RID]
0x0045	Keypad-ProgrammingEvent-Mask	map16	all	P	0xFFFF	RW VA	[NOT & PIN]
0x0046	RemoteProgrammingEvent-Mask	map16	all	P	0xFFFF	RW VA	[NOT]
0x0047	RFIDProgrammingEvent-Mask	map16	all	P	0xFFFF	RW VA	[NOT & RID]

AutoRelockTime, OperatingMode and SupportedOperatingModes represent mandatory fields that were previously not present or optional. Implementors should be aware that older devices may not implement them.

5.2.3.1. LockState Attribute

This attribute has the following possible values:

Value	Name	Conformance	Description
0	Not Fully Locked	M	Lock state is not fully locked
1	Locked	M	Lock state is fully locked

Value	Name	Conformance	Description
2	Unlocked	M	Lock state is fully unlocked

The LockState Attribute may be NULL if the lock hardware does not currently know the status of the locking mechanism. For example, a lock may not know the LockState status after a power cycle until the first lock actuation is completed.

The Not Fully Locked value is used by a lock to indicate that the state of the lock is somewhere between Locked and Unlocked so it is only partially secured. For example, a deadbolt could be partially extended and not in a dead latched state.

If the Scenes server cluster is implemented on the same endpoint, the following extension field SHALL be added to the Scene Table:

- LockState

When the LockState attribute is part of a Scene table, the attribute is treated as a writable command; that is, setting the LockState to lock will command the lock to lock, and setting the LockState to unlock will command the lock to unlock. Setting the LockState attribute to “not fully locked” is not supported. The Transition Time field in the Scene table will be treated as a delay before setting the LockState attribute; that is, it is possible to activate a scene with the lock actuation some seconds later.

Locks that do not have an actuation mechanism SHOULD not support the Scene table extension.

5.2.3.2. LockType Attribute

The LockType attribute is indicated by an enumeration:

Value	Name	Description
0	Dead bolt	Physical lock type is dead bolt
1	Magnetic	Physical lock type is magnetic
2	Other	Physical lock type is other
3	Mortise	Physical lock type is mortise
4	Rim	Physical lock type is rim
5	Latch Bolt	Physical lock type is latch bolt
6	Cylindrical Lock	Physical lock type is cylindrical lock
7	Tubular Lock	Physical lock type is tubular lock
8	Interconnected Lock	Physical lock type is interconnected lock
9	Dead Latch	Physical lock type is dead latch

Value	Name	Description
10	Door Furniture	Physical lock type is door furniture

5.2.3.3. ActuatorEnabled Attribute

The ActuatorEnabled attribute indicates if the lock is currently able to (Enabled) or not able to (Disabled) process remote Lock, Unlock, or Unlock with Timeout commands.

This attribute has the following possible values:

Boolean Value	Definition
0	Disabled
1	Enabled

5.2.3.4. DoorState Attribute

The current door state as defined in [DoorStateEnum](#).

This attribute SHALL be null only if an internal error prevents the retrieval of the current door state.

5.2.3.5. DoorOpenEvents Attribute

This attribute holds the number of door open events that have occurred since it was last zeroed.

5.2.3.6. DoorClosedEvents Attribute

This attribute holds the number of door closed events that have occurred since it was last zeroed.

5.2.3.7. OpenPeriod Attribute

This attribute holds the number of minutes the door has been open since the last time it transitioned from closed to open.

5.2.3.8. NumberOfLogRecordsSupported Attribute

The number of available log records.

5.2.3.9. NumberOfTotalUsersSupported Attribute

Number of total users supported by the lock.

5.2.3.10. NumberOfPINUsersSupported Attribute

The number of PIN users supported.

5.2.3.11. NumberOfRFIDUsersSupported Attribute

The number of RFID users supported.

5.2.3.12. NumberOfWeekDaySchedulesSupportedPerUser Attribute

The number of configurable week day schedule supported per user.

5.2.3.13. NumberOfYearDaySchedulesSupportedPerUser Attribute

The number of configurable year day schedule supported per user.

5.2.3.14. NumberOfHolidaySchedulesSupported Attribute

The number of holiday schedules supported for the entire door lock device.

5.2.3.15. MaxPINCodeLength Attribute

An 8 bit value indicates the maximum length in bytes of a PIN Code on this device.

5.2.3.16. MinPINCodeLength Attribute

An 8 bit value indicates the minimum length in bytes of a PIN Code on this device.

5.2.3.17. MaxRFIDCodeLength Attribute

An 8 bit value indicates the maximum length in bytes of a RFID Code on this device. The value depends on the RFID code range specified by the manufacturer, if media anti-collision identifiers (UID) are used as RFID code, a value of 20 (equals 10 Byte ISO 14443A UID) is recommended.

5.2.3.18. MinRFIDCodeLength Attribute

An 8 bit value indicates the minimum length in bytes of a RFID Code on this device. The value depends on the RFID code range specified by the manufacturer, if media anti-collision identifiers (UID) are used as RFID code, a value of 8 (equals 4 Byte ISO 14443A UID) is recommended.

5.2.3.19. CredentialRulesSupport Attribute

This bitmap contains a bit for every value of [CredentialRuleEnum](#) supported on this device.

Bit	CredentialRuleEnum	Definition
0	Single	Only one credential is required for lock operation
1	Dual	Any two credentials are required for lock operation
2	Tri	Any three credentials are required for lock operation

5.2.3.20. NumberOfCredentialsSupportedPerUser Attribute

The number of credentials that could be assigned for each user.

Depending on the value of NumberOfRFIDUsersSupported and NumberOfPINUsersSupported it may not be possible to assign that number of credentials for a user.

For example, if the device supports only PIN and RFID credential types, NumberOfCredentialsSupportedPerUser is set to 10, NumberOfPINUsersSupported is set to 5 and NumberOfRFIDUsersSupported is set to 3, it will not be possible to actually assign 10 credentials for a user because maximum number of credentials in the database is 8.

5.2.3.21. EnableLogging Attribute

Enable/disable event logging. When event logging is enabled, all event messages are stored on the lock for retrieval. Logging events can be but not limited to Tamper Alarm, Lock, Unlock, AutoRelock, User Code Added, User Code Cleared, Schedule Added, and Schedule Cleared. For a full detail of all the possible alarms and events, please refer to the full list in the Alarm and Event Masks Attribute Set.

5.2.3.22. Language Attribute

Modifies the language for the on-screen or audible user interface using a 2-byte language code from ISO-639-1.

5.2.3.23. OperatingMode Attribute

The current operating mode of the lock (see [OperatingModeEnum](#)).

5.2.3.24. SupportedOperatingModes Attribute

This bitmap contains all operating bits of the Operating Mode Attribute supported by the lock. All operating modes NOT supported by a lock SHALL be set to one. The value of the OperatingMode enumeration defines the related bit to be set, as shown below:

Bit	OperatingMode	Conformance
0	Normal	M
1	Vacation	O
2	Privacy	O
3	NoRemoteLockUnlock	M
4	Passage	O

5.2.3.25. LEDSettings Attribute

The settings for the LED support three different modes, shown below:

Attribute Identifier	Definition
0	Never use LED for signalization

Attribute Identifier	Definition
1	Use LED signalization except for access allowed events
2	Use LED signalization for all events

5.2.3.26. AutoRelockTime Attribute

The number of seconds to wait after unlocking a lock before it automatically locks again. 0=disabled. If set, unlock operations from any source will be timed. For one time unlock with timeout use the specific command.

5.2.3.27. SoundVolume Attribute

The sound volume on a door lock has four possible settings: silent, low, high and medium volumes, shown below:

Attribute Identifier	Definition
0	Silent Mode
1	Low Volume
2	High Volume
3	Medium Volume

5.2.3.28. DefaultConfigurationRegister Attribute

This attribute represents the default configurations as they are physically set on the device (example: hardware dip switch setting, etc...) and represents the default setting for some of the attributes within this cluster (for example: LED, Auto Lock, Sound Volume, and Operating Mode attributes).

This is a read-only attribute and is intended to allow clients to determine what changes MAY need to be made without having to query all the included attributes. It MAY be beneficial for the clients to know what the device's original settings were in the event that the device needs to be restored to factory default settings.

If the Client device would like to query and modify the door lock server's operating settings, it SHOULD send read and write attribute requests to the specific attributes.

For example, the Sound Volume attribute default value is Silent Mode. However, it is possible that the current Sound Volume is High Volume. Therefore, if the client wants to query/modify the current Sound Volume setting on the server, the client SHOULD read/write to the Sound Volume attribute.

This attribute has the following possible values:

Bit	Description
0	0 - Enable Local Programming Attribute default value is 0 (disabled) 1 - Enable Local Programming Attribute default value is 1 (enabled)
1	0 – Keypad Interface default access is disabled 1 - Keypad Interface default access is enabled
2	0 - Remote Interface default access is disabled 1 - Remote Interface default access is enabled
5	0 – Sound Volume attribute default value is 0 (Silent Mode) 1 – Sound Volume attribute default value is equal to something other than 0
6	0 – Auto Relock Time attribute default value = 0 1 – Auto Relock Time attribute default value is equal to something other than 0
7	0 – Led Settings attribute default value = 0 1 – Led Settings attribute default value is equal to something other than 0

5.2.3.29. EnableLocalProgramming Attribute

Enable/disable local programming on the door lock of certain features (see LocalProgrammingFeatures attribute). If this value is set to TRUE then local programming is enabled on the door lock for all features. If it is set to FALSE then local programming is disabled on the door lock for those features whose bit is set to 0 in the LocalProgrammingFeatures attribute. Local programming SHALL be enabled by default.

5.2.3.30. EnableOneTouchLocking Attribute

Enable/disable the ability to lock the door lock with a single touch on the door lock.

5.2.3.31. EnableInsideStatusLED Attribute

Enable/disable an inside LED that allows the user to see at a glance if the door is locked.

5.2.3.32. EnablePrivacyModeButton Attribute

Enable/disable a button inside the door that is used to put the lock into privacy mode. When the lock is in privacy mode it cannot be manipulated from the outside.

5.2.3.33. LocalProgrammingFeatures Attribute

The local programming features that will be disabled when EnableLocalProgramming attribute is set to False. If a door lock doesn't support disabling one aspect of local programming it SHALL return CONSTRAINT_ERROR during a write operation of this attribute. If the EnableLocalProgramming attribute is set to True then all local programming features SHALL be enabled regardless of the bits set to 0 in this attribute.

The features that can be disabled from local programming are defined in the following bitmap.

Bit	Description
0	0 - The ability to add Users/credentials/Schedules locally is disabled 1 - The ability to add Users/Credentials/Schedules locally is enabled
1	0 - The ability to modify Users/credentials/Schedules locally is disabled 1 - The ability to modify Users/Credentials/Schedules locally is enabled
2	0 - The ability to clear Users/credentials/Schedules locally is disabled 1 - The ability to clear Users/Credentials/Schedules locally is enabled
3	0 - The ability to adjust lock settings locally is disabled 1 - The ability to adjust lock settings locally is enabled

5.2.3.34. WrongCodeEntryLimit Attribute

The number of incorrect Pin codes or RFID presentation attempts a user is allowed to enter before the lock will enter a lockout state. The value of this attribute is compared to all failing forms of credential presentation, including Pin codes used in an Unlock Command when RequirePINforRemoteOperation is set to true. Valid range is 1-255 incorrect attempts. The lockout state will be for the duration of UserCodeTemporaryDisableTime. If the attribute accepts writes and an attempt to write the value 0 is made, the device SHALL respond with CONSTRAINT_ERROR.

The lock MAY reset the counter used to track incorrect credential presentations as required by internal logic, environmental events, or other reasons. The lock SHALL reset the counter if a valid credential is presented.

5.2.3.35. **UserCodeTemporaryDisableTime Attribute**

The number of seconds that the lock shuts down following wrong code entry. Valid range is 1-255 seconds. Device can shut down to lock user out for specified amount of time. (Makes it difficult to try and guess a PIN for the device.) If the attribute accepts writes and an attempt to write the attribute to 0 is made, the device SHALL respond with CONSTRAINT_ERROR.

5.2.3.36. **SendPINOverTheAir Attribute**

Boolean set to True if it is ok for the door lock server to send PINs over the air. This attribute determines the behavior of the server's TX operation. If it is false, then it is not ok for the device to send PIN in any messages over the air.

The PIN field within any door lock cluster message SHALL keep the first octet unchanged and masks the actual code by replacing with 0xFF. For example (PIN "1234"): If the attribute value is True, 0x04 0x31 0x32 0x33 0x34 SHALL be used in the PIN field in any door lock cluster message payload. If the attribute value is False, 0x04 0xFF 0xFF 0xFF 0xFF SHALL be used.

If the USR feature is supported by the device then this attribute SHALL NOT be supported.

5.2.3.37. **RequirePINForRemoteOperation Attribute**

Boolean set to True if the door lock server requires that an optional PINs be included in the payload of remote lock operation events like Lock, Unlock, Unlock with Timeout and Toggle in order to function.

5.2.3.38. **ExpiringUserTimeout Attribute**

Number of minutes a PIN, RFID, Fingerprint, or other credential associated with a user of type ExpiringUser SHALL remain valid after its first use before expiring. When the credential expires the UserStatus for the corresponding user record SHALL be set to OccupiedDisabled.

5.2.3.39. **AlarmMask Attribute**

This attribute is only supported if the Alarms cluster is on the same endpoint. The alarm mask is used to turn on/off alarms for particular functions. Alarms for an alarm group are enabled if the associated alarm mask bit is set. Each bit represents a group of alarms. Entire alarm groups can be turned on or off by setting or clearing the associated bit in the alarm mask.

This attribute has the following possible values:

This mask DOES NOT apply to the Events mechanism of this cluster.

Alarm Code	Bit	Alarm Condition	Conformance
0	0	Locking Mechanism Jammed	M
1	1	Lock Reset to Factory Defaults	O
2	2	Reserved	O

Alarm Code	Bit	Alarm Condition	Conformance
3	3	RF Module Power Cycled	O
4	4	Tamper Alarm - wrong code entry limit	PIN RID
5	5	Tamper Alarm - front escutcheon removed from main	O
6	6	Forced Door Open under Door Locked Condition	O

5.2.3.40. KeypadOperationEventMask Attribute

Event mask used to turn on and off the transmission of keypad operation events. This mask DOES NOT apply to the storing of events in the event log. This mask only applies to the Operation Event Notification Command.

This attribute has the following possible values:

Event Source	Operation Event Code	Attribute Bitmask	Event Description
0	0	BIT(0)	Unknown or manufacturer-specific keypad operation event
0	1	BIT(1)	Lock, source: keypad
0	2	BIT(2)	Unlock, source: keypad
0	3	BIT(3)	Lock, source: keypad, error: invalid PIN
0	4	BIT(4)	Lock, source: keypad, error: invalid schedule
0	5	BIT(5)	Unlock, source: keypad, error: invalid code
0	6	BIT(6)	Unlock, source: keypad, error: invalid schedule
0	15	BIT(7)	Non-Access User operation event, source keypad.

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.3.41. RemoteOperationEventMask Attribute

Event mask used to turn on and off the transmission of remote operation events. This mask DOES NOT apply to the storing of events in the event log. This mask only applies to the Operation Event

Notification Command.

This attribute has the following possible values:

Event Source	Operation Event Code	Attribute Bitmask	Event Description
1	0	BIT(0)	Unknown or manufacturer-specific remote operation event
1	1	BIT(1)	Lock, source: remote
1	2	BIT(2)	Unlock, source: remote
1	3	BIT(3)	Lock, source: remote, error: invalid code
1	4	BIT(4)	Lock, source: remote, error: invalid schedule
1	5	BIT(5)	Unlock, source: remote, error: invalid code
1	6	BIT(6)	Unlock, source: remote, error: invalid schedule

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.3.42. ManualOperationEventMask Attribute

Event mask used to turn on and off manual operation events. This mask DOES NOT apply to the storing of events in the event log. This mask only applies to the Operation Event Notification Command.

This attribute has the following possible values:

Event Source	Operation Event Code	Attribute Bitmask	Event Description
2	0	BIT(0)	Unknown or manufacturer-specific manual operation event
2	1	BIT(1)	Thumtturn Lock
2	2	BIT(2)	Thumtturn Unlock
2	7	BIT(3)	One touch lock
2	8	BIT(4)	Key Lock
2	9	BIT(5)	Key Unlock
2	10	BIT(6)	Auto lock
2	11	BIT(7)	Schedule Lock
2	12	BIT(8)	Schedule Unlock

Event Source	Operation Event Code	Attribute Bitmask	Event Description
2	13	BIT(9)	Manual Lock (Key or Thumbturn)
2	14	BIT(10)	Manual Unlock (Key or Thumbturn)

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.3.43. RFIDOperationEventMask Attribute

Event mask used to turn on and off RFID operation events. This mask DOES NOT apply to the storing of events in the event log. This mask only applies to the Operation Event Notification Command.

This attribute has the following possible values:

Event Source	Operation Event Code	Attribute Bitmask	Event Description
3	0	BIT(0)	Unknown or manufacturer-specific keypad operation event
3	1	BIT(1)	Lock, source: RFID
3	2	BIT(2)	Unlock, source: RFID
3	3	BIT(3)	Lock, source: RFID, error: invalid RFID ID
3	4	BIT(4)	Lock, source: RFID, error: invalid schedule
3	5	BIT(5)	Unlock, source: RFID, error: invalid RFID ID
3	6	BIT(6)	Unlock, source: RFID, error: invalid schedule

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.3.44. KeypadProgrammingEventMask Attribute

Event mask used to turn on and off keypad programming events. This mask DOES NOT apply to the storing of events in the event log. This mask only applies to the Programming Event Notification Command.

This attribute has the following possible values:

Event Source	Program Event Code	Attribute Bitmask	Event Description
0	0	BIT(0)	Unknown or manufacturer-specific keypad programming event

Event Source	Program Event Code	Attribute Bitmask	Event Description
0	1	BIT(1)	<p>Programming PIN code changed, source: keypad</p> <p>User ID: programming user ID.</p> <p>PIN: default or programming PIN code if codes can be sent over the air per attribute.</p> <p>User type: default</p> <p>User Status: default</p>
0	2	BIT(2)	<p>PIN added, source: keypad</p> <p>User ID: user ID that was added.</p> <p>PIN: code that was added (if codes can be sent over the air per attribute.)</p> <p>User type: default or type added.</p> <p>User Status: default or status added.</p>
0	3	BIT(3)	<p>PIN cleared, source: keypad</p> <p>User ID: user ID that was cleared.</p> <p>PIN: code that was cleared (if codes can be sent over the air per attribute.)</p> <p>User type: default or type cleared.</p> <p>User Status: default or status cleared.</p>

Event Source	Program Event Code	Attribute Bitmask	Event Description
0	4	BIT(4)	<p>PIN changed</p> <p>Source: keypad</p> <p>User ID: user ID that was changed</p> <p>PIN: code that was changed (if codes can be sent over the air per attribute.)</p> <p>User type: default or type changed.</p> <p>User Status: default or status changed.</p>

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.3.45. RemoteProgrammingEventMask Attribute

Event mask used to turn on and off remote programming events. This mask DOES NOT apply to the storing of events in the event log. This mask only applies to the Programming Event Notification Command.

This attribute has the following possible values:

Event Source	Program Event Code	Attribute Bitmask	Event Description
1	0	BIT(0)	Unknown or manufacturer-specific remote programming event.
1	2	BIT(2)	<p>PIN added, source remote</p> <p>Same as keypad source above</p>
1	3	BIT(3)	<p>PIN cleared, source remote</p> <p>Same as keypad source above.</p>

Event Source	Program Event Code	Attribute Bitmask	Event Description
1	4	BIT(4)	PIN changed Source remote Same as keypad source above
1	5	BIT(5)	RFID code added, Source remote
1	6	BIT(6)	RFID code cleared, Source remote

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.3.46. RFIDProgrammingEventMask Attribute

Event mask used to turn on and off RFID programming events. This mask DOES NOT apply to the storing of events in the event log. This mask only applies to the Programming Event Notification Command.

This attribute has the following possible values:

Event Source	Program Event Code	Attribute Bitmask	Event Description
3	0	BIT(0)	Unknown or manufacturer-specific keypad programming event
3	5	BIT(5)	ID Added, Source: RFID User ID: user ID that was added. ID: ID that was added (if codes can be sent over the air per attribute.) User Type: default or type added. User Status: default or status added.

Event Source	Program Event Code	Attribute Bitmask	Event Description
3	6	BIT(6)	<p>ID cleared, Source: RFID</p> <p>User ID: user ID that was cleared.</p> <p>ID: ID that was cleared (if codes can be sent over the air per attribute.)</p> <p>User Type: default or type cleared.</p> <p>User Status: default or status cleared.</p>

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.4. Commands

Id	Name	Direction	Response	Access	Conformance
0x00	Lock Door	Client ⇒ Server	Y	T O	M
0x01	Unlock Door	Client ⇒ Server	Y	T O	M
0x02	Toggle	Client ⇒ Server	Y	T O	X
0x03	Unlock with Timeout	Client ⇒ Server	Y	T O	O
0x04	Get Log Record	Client ⇒ Server	Get Log Record Response	M	LOG
0x04	Get Log Record Response	Server ⇒ Client	N		LOG
0x05	Set PIN Code	Client ⇒ Server	Y	T A	!USR & PIN
0x06	Get PIN Code	Client ⇒ Server	Get PIN Code Response	A	!USR & PIN
0x06	Get PIN Code Response	Server ⇒ Client	N		!USR & PIN
0x07	Clear PIN Code	Client ⇒ Server	Y	T A	!USR & PIN
0x08	Clear All PIN Codes	Client ⇒ Server	Y	T A	!USR & PIN

Id	Name	Direction	Response	Access	Conformance
0x09	Set User Status	Client ⇒ Server	Y	A	!USR & (PIN RID FGP)
0x0a	Get User Status	Client ⇒ Server	Get User Status Response	A	!USR & (PIN RID FGP)
0x0a	Get User Status Response	Server ⇒ Client	N		!USR
0x0b	Set Week Day Schedule	Client ⇒ Server	Y	A	WDSCH
0x0c	Get Week Day Schedule	Client ⇒ Server	Get Week Day Schedule Response	A	WDSCH
0x0c	Get Week Day Schedule Response	Server ⇒ Client	N		WDSCH
0x0d	Clear Week Day Schedule	Client ⇒ Server	Y	A	WDSCH
0x0e	Set Year Day Schedule	Client ⇒ Server	Y	A	YDSCH
0x0f	Get Year Day Schedule	Client ⇒ Server	Get Year Day Schedule Response	A	YDSCH
0x0f	Get Year Day Schedule Response	Server ⇒ Client	N		YDSCH
0x10	Clear Year Day Schedule	Client ⇒ Server	Y	A	YDSCH
0x11	Set Holiday Schedule	Client ⇒ Server	Y	A	HDSCH
0x12	Get Holiday Schedule	Client ⇒ Server	Get Holiday Schedule Response	A	HDSCH
0x12	Get Holiday Schedule Response	Server ⇒ Client	N		HDSCH
0x13	Clear Holiday Schedule	Client ⇒ Server	Y	A	HDSCH
0x14	Set User Type	Client ⇒ Server	Y	A	!USR & (PIN RID FGP)
0x15	Get User Type	Client ⇒ Server	Get User Type Response	A	!USR & (PIN RID FGP)

Id	Name	Direction	Response	Access	Conformance
0x15	Get User Type Response	Server ⇒ Client	N		!USR
0x16	Set RFID Code	Client ⇒ Server	Y	T A	!USR & RID
0x17	Get RFID Code	Client ⇒ Server	Get RFID Code Response	A	!USR & RID
0x17	Get RFID Code Response	Server ⇒ Client	N		!USR & RID
0x18	Clear RFID Code	Client ⇒ Server	Y	T A	!USR & RID
0x19	Clear All RFID Codes	Client ⇒ Server	Y	T A	!USR & RID
0x1a	Set User	Client ⇒ Server	Y	T A	USR
0x1b	Get User	Client ⇒ Server	Get User Response	A	USR
0x1c	Get User Response	Server ⇒ Client	N		USR
0x1d	Clear User	Client ⇒ Server	Y	T A	USR
0x20	Operating Event Notification	Server ⇒ Client	N		[NOT]
0x21	Programming Event Notification	Server ⇒ Client	N		[NOT]
0x22	Set Credential	Client ⇒ Server	Set Credential Response	T A	USR
0x23	Set Credential Response	Server ⇒ Client	N		USR
0x24	Get Credential Status	Client ⇒ Server	Get Credential Status Response	A	USR
0x25	Get Credential Status Response	Server ⇒ Client	N		USR
0x26	Clear Credential	Client ⇒ Server	Y	T A	USR

5.2.4.1. Lock Door Command

This command causes the lock device to lock the door. This command includes an optional code for the lock. The door lock MAY require a PIN depending on the value of the [Require PIN for Remote

Operation attribute].

Id	Field	Type	Constraint	Quality	Default	Conformance
0	PINCode	octstr				[COTA & PIN]

† The PIN/RFID Code is an obsolete field name, use PINCode instead.

5.2.4.1.1. PINCode

If the RequirePINforRemoteOperation attribute is True then PINCode field SHALL be provided and the door lock SHALL NOT grant access if it is not provided.

If the PINCode field is provided, the door lock SHALL verify PINCode before granting access regardless of the value of RequirePINForRemoteOperation attribute.

When the PINCode field is provided an invalid PIN will count towards the WrongCodeEntryLimit and the UserCodeTemporaryDisableTime will be triggered if the WrongCodeEntryLimit is exceeded. The lock SHALL ignore any attempts to lock/unlock the door until the UserCodeTemporaryDisableTime expires.

5.2.4.2. Unlock Door Command

This command causes the lock device to unlock the door. This command includes an optional code for the lock. The door lock MAY require a code depending on the value of the [Require PIN for Remote Operation attribute].

Note: If the attribute AutoRelockTime is supported the lock will transition to the locked state when the auto relock time has expired.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	PINCode	octstr				[COTA & PIN]

† The PIN/RFID Code is an obsolete field name, use PINCode instead.

5.2.4.2.1. PINCode

See [PINCode](#).

5.2.4.3. Unlock with Timeout Command

This command causes the lock device to unlock the door with a timeout parameter. After the time

in seconds specified in the timeout field, the lock device will relock itself automatically. This timeout parameter is only temporary for this message transition and overrides the default relock time as specified in the AutoRelockTime attribute. If the door lock device is not capable of or does not want to support temporary Relock Timeout, it SHOULD NOT support this optional command.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Timeout	uint16				M
1	PINCode PIN/RFID Code†	octstr				[COTA & PIN]

† The PIN/RFID Code is an obsolete field name, use PINCode instead.

5.2.4.3.1. Timeout

The timeout in seconds to wait before relocking the door lock. This value is independent of the AutoRelockTime attribute value.

5.2.4.3.2. PINCode

See [PINCode](#).

5.2.4.4. Get Log Record Command

Request a log record. Log number is between 1 – [Number of Log Records Supported attribute]. If log number 0 is requested then the most recent log entry is returned.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Log Index	uint16	desc			M

Log record format: The log record format is defined in the description of the Get Log Record Response command.

5.2.4.5. Get Log Record Response Command

Returns the specified log record. If an invalid log entry ID was requested, it is set to 0 and the most recent log entry will be returned.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Log Entry ID	uint16	desc			M
1	Timestamp	epoch-s	all			M
2	Event Type	enum8	desc			M

Id	Field	Type	Constraint	Quality	Default	Conformance
3	Source (see Operation Event Sources)	uint8	desc			M
4	Event ID/Alarm Code (see Operation Event Codes)	uint8	desc			M
5	User ID	uint16	desc			M
6	PIN	octstr				M

Log Entry ID: the index into the log table where this log entry is stored. If the log entry requested is 0, the most recent log is returned with the appropriate log entry ID.

Timestamp: A timestamp for all events and alarms on the door lock in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day of the event.

Event Type: Indicates the type of event that took place on the door lock.

0 = Operation

1 = Programming

2 = Alarm

Source: A source value where available sources are:

0x00 = Keypad

0x01 = Remote

0x02 = Manual

0x03 = RFID

0xFF = Indeterminate

If the Event type is 0x02 (Alarm) then the source SHOULD be but does not have to be 0xff (Indeterminate).

Event ID: A one-byte value indicating the type of event that took place on the door lock depending on the event code table provided for a given event type and source.

User ID: A two-byte value indicating the ID of the user who generated the event on the door lock if one is available. If none is available, 0xffff has to be used.

PIN / ID: A string indicating the PIN code or RFID code that was used to create the event on the door lock if one is available.

5.2.4.6. Set PIN Code Command

Set a PIN Code into the lock.

Id	Field	Type	Constraint	Quality	Default	Confor-mance
0	User ID	uint16	desc			M
1	User Status	uint8	UserStatusEnum	X	OccupiedEnabled	M
2	User Type	enum8	UserTypeEnum	X	Unrestrict-edUser	M
3	PIN	octstr				M

User ID is between 0 - [# of PIN Users Supported attribute]. Only the values 1 (Occupied/Enabled) and 3 (Occupied/Disabled) are allowed for User Status.

Return status is a global status code or a cluster-specific status code from the [DoorLockStatus](#) table and SHALL be one of the following values:

Name	Description
SUCCESS	Setting PIN code was successful.
FAILURE	Setting PIN code failed.
CONSTRAINT_ERROR	Setting PIN code failed because User ID requested was out of range.
DUPLICATE	Setting PIN code failed because it would create a duplicate PIN code.

5.2.4.7. Get PIN Code Command

Retrieve a PIN Code. User ID is between 0 - [# of PIN Users Supported attribute].

Id	Field	Type	Constraint	Quality	Default	Confor-mance
0	User ID	uint16	desc			M

5.2.4.8. Get PIN Code Response Command

Returns the PIN for the specified user ID.

Id	Field	Type	Constraint	Quality	Default	Confor-mance
0	User ID	uint16	desc			M

Id	Field	Type	Constraint	Quality	Default	Conformance
1	User Status	uint8	UserStatusEnum	X	Available	M
2	User Type	enum8	UserTypeEnum	X		M
3	PIN Code	octstr		X	empty	M

If the requested User ID is valid and the Code doesn't exist, Get RFID Code Response SHALL have the following format:

User ID = requested User ID

UserStatus = 0 (available)

UserType = 0xFF (not supported)

PIN Code = 0 (zero length)

If the requested User ID is invalid, send Default Response with an error status. The error status SHALL be equal to CONSTRAINT_ERROR when User_ID is less than the max number of users supported, and NOT_FOUND if greater than or equal to the max number of users supported.

5.2.4.9. Clear PIN Code Command

Clear a PIN code or all PIN codes.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	PINSlotIndex	uint16	1 to NumberofPINUsersSupported,			M
	User ID†		0xFFFF			

† The User ID is an obsolete field name, use PINSlotIndex instead.

For each PIN Code cleared whose user doesn't have a RFID Code or other credential type, then corresponding user record's UserStatus value SHALL be set to Available, and UserType value SHALL be set to UnrestrictedUser and all schedules SHALL be cleared.

5.2.4.9.1. PINSlotIndex

Specifies a valid PIN code slot index or 0xFFFF to indicate all PIN code slots SHALL be cleared.

5.2.4.10. Clear All PIN Codes Command

Clear out all PINs on the lock.

Note: On the server, the clear all PIN codes command SHOULD have the same effect as the Clear PIN Code command with respect to the setting of user status, user type and schedules.

5.2.4.11. Set User Status Command

Set the status of a user ID. User Status value of 0 is not allowed. In order to clear a user id, the Clear ID Command SHALL be used. For user status value please refer to User Status Value.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M
1	User Status	uint8	UserStatusEnum			M

5.2.4.12. Get User Status Command

Get the status of a user.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M

5.2.4.13. Get User Status Response Command

Returns the user status for the specified user ID. If the requested User ID is invalid, the Status field SHALL be set to FAILURE. If the command is successful, the Status field SHALL be set to SUCCESS.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M
1	User Status	enum8	UserStatusEnum			M

5.2.4.14. Set Week Day Schedule Command

Set a weekly repeating schedule for a specified user.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	WeekDayIndex	uint8	1 to NumberOfWeek-DaySchedulesSupportedPerUser			M
	Schedule ID†					

Id	Field	Type	Constraint	Quality	Default	Conformance
1	UserIndex	uint16	1 to NumberOfTotalUsersSupported			M
	User ID†					
2	DaysMask	DaysMaskMap				M
3	StartHour	uint8	0 to 23			M
4	StartMinute	uint8	0 to 59			M
5	EndHour	uint8	0 to 23			M
6	EndMinute	uint8	0 to 59			M

† The Schedule ID and User ID are obsolete field names, use WeekDayIndex and UserIndex instead, respectively.

The associated UserType MAY be changed to ScheduleRestrictedUser by the lock when a Week Day schedule is set.

Return status SHALL be one of the following values:

Name	Description
SUCCESS	Setting Week Day schedule was successful.
FAILURE	Some unexpected internal error occurred setting Week Day schedule.
INVALID_COMMAND	<p>One or more fields violates constraints or is invalid.</p> <p>Door lock is unable to set Week Day schedule for more than one day in DaysMask map (e.g. need to use separate schedules for each day).</p>

5.2.4.14.1. StartHour

This indicates the starting hour for the Week Day schedule.

5.2.4.14.2. StartMinute

This indicates the starting minute for the Week Day schedule.

5.2.4.14.3. EndHour

The ending hour for the Week Day schedule. EndHour SHALL be equal to or greater than StartHour.

5.2.4.14.4. EndMinute

The ending minute for the Week Day schedule. If EndHour is equal to StartHour then EndMinute SHALL be greater than StartMinute.

If the EndHour is equal to 23 and the EndMinute is equal to 59 the Lock SHALL grant access to the user up until 23:59:59.

5.2.4.15. Get Week Day Schedule Command

Retrieve the specific weekly schedule for the specific user.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	WeekDayIndex	uint8	1 to NumberOfWeek-DaySchedulesSupportedPerUser			M
1	UserIndex	uint16	1 to NumberOfTotalUsersSupported			M
	User ID†					

† The Schedule ID and User ID are obsolete field names, use WeekDayIndex and UserIndex instead, respectively.

5.2.4.16. Get Week Day Schedule Response Command

Returns the weekly repeating schedule data for the specified schedule index.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	WeekDayIndex	uint8	1 to NumberOfWeek-DaySchedulesSupportedPerUser			M
1	UserIndex	uint16	1 to NumberOfTotalUsersSupported			M
	User ID†					
2	Status	enum8	desc		SUCCESS	M
3	DaysMask	DaysMaskMap				O
4	StartHour	uint8	0 to 23			O

Id	Field	Type	Constraint	Quality	Default	Conformance
5	StartMinute	uint8	0 to 59			O
6	EndHour	uint8	0 to 23			O
7	EndMinute	uint8	0 to 59			O

† The Schedule ID and User ID are obsolete field names, use WeekDayIndex and UserID instead, respectively.

5.2.4.16.1. Status

Status SHALL be one of the following values:

SUCCESS if both WeekDayIndex and UserID are valid and there is a corresponding schedule entry.

INVALID_COMMAND if either WeekDayIndex and/or UserID values are not within valid range

NOT_FOUND if both WeekDayIndex and UserID are within the valid range, however, there is not corresponding schedule entry found.

Only if the status is SUCCESS that other remaining fields are included. For other (error) status values, only the fields up to the status field SHALL be present.

5.2.4.16.2. StartHour

This indicates the starting hour for the Week Day schedule.

5.2.4.16.3. StartMinute

This indicates the starting minute for the Week Day schedule.

5.2.4.16.4. EndHour

This indicates the ending hour for the Week Day schedule. EndHour SHALL be equal to or greater than StartHour.

5.2.4.16.5. EndMinute

The ending minute for the Week Day schedule. If EndHour is equal to StartHour then EndMinute SHALL be greater than StartMinute.

5.2.4.17. Clear Week Day Schedule Command

Clear the specific weekly schedule or all weekly schedules for the specific user.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	WeekDayIndex Schedule ID†	uint8	1 to NumberOfWeekDaySchedulesSupportedPerUser, 0xFE			M
1	UserIndex User ID†	uint16	1 to NumberOfTotalUsersSupported			M

† The Schedule ID and User ID are obsolete field names, use WeekDayIndex and UserIndex instead, respectively.

Return status SHALL be one of the following values:

Name	Description
SUCCESS	Clearing Week Day schedule(s) was successful.
FAILURE	Some unexpected internal error occurred clearing Week Day schedule.
INVALID_COMMAND	One or more fields violates constraints or is invalid.

5.2.4.17.1. WeekDayIndex

The Week Day schedule index to clear or 0xFE to clear all Week Day schedules for the specified user.

5.2.4.18. Set Year Day Schedule Command

Set a time-specific schedule ID for a specified user.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	YearDayIndex Schedule ID†	uint8	1 to NumberOfYearDaySchedulesSupportedPerUser			M
1	UserIndex User ID†	uint16	1 to NumberOfTotalUsersSupported			M

Id	Field	Type	Constraint	Quality	Default	Conformance
2	LocalStart-Time	epoch-s	all			M
3	LocalEnd-Time	epoch-s	all			M

† The Schedule ID and User ID are obsolete field names, use YearDayIndex and UserID instead, respectively.

The associated UserType MAY be changed to ScheduleRestrictedUser by the lock when a Year Day schedule is set.

Return status SHALL be one of the following values:

Name	Description
SUCCESS	Setting Year Day schedule was successful.
FAILURE	Some unexpected internal error occurred setting Year Day schedule.
INVALID_COMMAND	One or more fields violates constraints or is invalid.

5.2.4.18.1. LocalStartTime

The starting time for the Year Day schedule in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value.

5.2.4.18.2. LocalEndTime

The ending time for the Year Day schedule in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value. LocalEndTime SHALL be greater than LocalStartTime.

5.2.4.19. Get Year Day Schedule Command

Retrieve the specific year day schedule for the specific schedule and user indexes.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	YearDayIndex	uint8	1 to NumberOfYear-DaySchedulesSupportedPerUser			M

Id	Field	Type	Constraint	Quality	Default	Conformance
1	UserIndex User ID†	uint16	1 to NumberOfTotalUsersSupported			M

† The Schedule ID and User ID are obsolete field names, use YearDayIndex and UserIndex instead, respectively.

5.2.4.20. Get Year Day Schedule Response Command

Returns the year day schedule data for the specified schedule and user indexes.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	YearDayIndex Schedule ID†	uint8	1 to NumberOfYear-DaySchedulesSupportedPerUser			M
1	UserIndex User ID†	uint16	1 to NumberOfTotalUsersSupported			M
2	Status	enum8	desc		SUCCESS	M
2	LocalStartTime	epoch-s	all	X		M
3	LocalEndTime	epoch-s	all	X		M

† The Schedule ID and User ID are obsolete field names, use YearDayIndex and UserIndex instead, respectively.

5.2.4.20.1. Status

Status SHALL be one of the following values:

SUCCESS if both YearDayIndex and UserIndex are valid and there is a corresponding schedule entry.

INVALID_COMMAND if either YearDayIndex and/or UserIndex values are not within valid range

NOT_FOUND if both YearDayIndex and UserIndex are within the valid range, however, there is not corresponding schedule entry found.

All fields SHALL be included irrespective of the value of the Status field. For error status values, the

LocalStartTime and LocalEndTime fields SHALL be set to null.

5.2.4.20.2. LocalStartTime

The starting time for the Year Day schedule in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value. This SHALL be null if the schedule is not set for the YearDayIndex and UserIndex provided.

5.2.4.20.3. LocalEndTime

The ending time for the Year Day schedule in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value. LocalEndTime SHALL be greater than LocalStartTime. This SHALL be null if the schedule is not set for the YearDayIndex and UserIndex provided.

5.2.4.21. Clear Year Day Schedule Command

Clears the specific year day schedule or all year day schedules for the specific user.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	YearDayIndex Schedule ID†	uint8	1 to NumberOfYear-DaySchedulesSupportedPerUser, 0xFE			M
1	UserIndex User ID†	uint16	1 to NumberOfTotalUsersSupported			M

† The Schedule ID and User ID are obsolete field names, use YearDayIndex and UserIndex instead, respectively.

Return status SHALL be one of the following values:

Name	Description
SUCCESS	Clearing Year Day schedule(s) was successful.
FAILURE	Some unexpected internal error occurred clearing Year Day schedule.
INVALID_COMMAND	One or more fields violates constraints or is invalid.

5.2.4.21.1. YearDayIndex

The Year Day schedule index to clear or 0xFE to clear all Year Day schedules for the specified user.

5.2.4.22. Set Holiday Schedule Command

Set the holiday Schedule by specifying local start time and local end time with respect to any Lock Operating Mode.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	HolidayIndex Holiday Schedule ID†	uint8	1 to NumberOfHolidaysSupported			M
1	LocalStartTime	epoch-s	all			M
2	LocalEndTime	epoch-s	all			M
3	OperatingMode	OperatingModeEnum	all			M

† The Holiday Schedule ID is an obsolete field name, use HolidayIndex instead.

Return status SHALL be one of the following values:

Name	Description
SUCCESS	Setting Holiday schedule was successful.
FAILURE	Some unexpected internal error occurred setting Holiday schedule.
INVALID_COMMAND	One or more fields violates constraints or is invalid.

5.2.4.22.1. LocalStartTime

The starting time for the Holiday Day schedule in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value.

5.2.4.22.2. LocalEndTime

The ending time for the Holiday Day schedule in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value. LocalEndTime SHALL be greater than LocalStartTime.

5.2.4.22.3. OperatingMode

The operating mode to use during this Holiday schedule start/end time.

5.2.4.23. Get Holiday Schedule Command

Get the holiday schedule for the specified index.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	HolidayIndex Holiday Schedule ID†	uint8	1 to NumberOfHolidaySchedulesSupported			M

† The Holiday Schedule ID is an obsolete field name, use HolidayIndex instead.

5.2.4.24. Get Holiday Schedule Response Command

Returns the Holiday Schedule Entry for the specified Holiday ID.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	HolidayIndex Holiday Schedule ID†	uint8	1 to NumberOfHolidaySchedulesSupported			M
1	Status	enum8	desc		SUCCESS	M
2	LocalStartTime	epoch-s	all	X		O
3	Local End Time	epoch-s	all	X		O
4	Operating-Mode	Operating-ModeEnum	all	X		O

† The Holiday Schedule ID is an obsolete field name, use HolidayIndex instead.

5.2.4.24.1. Status

Status SHALL be one of the following values:

FAILURE if the attribute NumberOfHolidaySchedulesSupported is zero.

SUCCESS if the HolidayIndex is valid and there is a corresponding schedule entry.

INVALID_COMMAND if the HolidayIndex is not within valid range

NOT_FOUND if the HolidayIndex is within the valid range, however, there is not corresponding

schedule entry found.

Only if the status is SUCCESS that other remaining fields are included. For other (error) status values, only the fields up to the status field SHALL be present.

5.2.4.24.2. LocalStartTime

The starting time for the Holiday schedule in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value. This SHALL be null if the schedule is not set for the HolidayIndex provided.

5.2.4.24.3. LocalEndTime

The ending time for the Holiday schedule in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value. LocalEndTime SHALL be greater than LocalStartTime. This SHALL be null if the schedule is not set for the HolidayIndex provided.

5.2.4.24.4. OperatingMode

The operating mode to use during this Holiday schedule start/end time. This SHALL be null if the schedule is not set for the HolidayIndex provided.

5.2.4.25. Clear Holiday Schedule Command

Clears the holiday schedule or all holiday schedules.

Id	Field	Type	Constraint	Quality	Default	Confor- mance
0	HolidayIndex Holiday Schedule ID†	uint8	1 to NumberOfHolidaySchedulesSupported, 0xFE			M

† The Holiday Schedule ID is an obsolete field name, use HolidayIndex instead.

5.2.4.25.1. HolidayIndex

The Holiday schedule index to clear or 0xFE to clear all Holiday schedules.

5.2.4.26. Set User Type Command

Set the user type for a specified user.

For user type value please refer to User Type Value.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M
1	User Type	enum8	UserType-Enum			M

If UserType is currently YearDayScheduleUser, WeekDayScheduleUser, or ScheduleRestrictedUser and the new UserType is UnrestrictedUser then all existing Year Day and/or Week Day schedules SHALL be ignored or disabled (if this transition is supported by the door lock). If UserType is ScheduleRestrictedUser and the new UserType is ScheduleRestrictedUser then all existing Year Day and/or Week Day schedules SHALL be applied or enabled.

Return status SHALL be one of the following values:

Name	Description
SUCCESS	Setting User Type was successful.
FAILURE	Some unexpected internal error occurred setting User Type.
INVALID_COMMAND	<p>One or more fields violates constraints or is invalid.</p> <p>Door lock is unable to switch from restricted to unrestricted user (e.g. need to clear schedules to switch).</p>

5.2.4.27. Get User Type Command

Retrieve the user type for a specific user.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M

5.2.4.28. Get User Type Response Command

Returns the user type for the specified user ID. If the requested User ID is invalid, send Default Response with an error status equal to FAILURE.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M
1	User Type	enum8	UserType-Enum			M

5.2.4.29. Set RFID Code Command

Set an ID for RFID access into the lock.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M
1	User Status	uint8	UserStatusEnum	X	OccupiedEnabled	M
2	User Type	enum8	UserTypeEnum	X	UnrestrictedUser	M
3	RFID Code	octstr				M

User ID: Between 0 - [# of RFID Users Supported attribute]. Only the values 1 (Occupied/Enabled) and 3 (Occupied/Disabled) are allowed for User Status.

User Status: Used to indicate what the status is for a specific user ID. The values are according to “Set PIN” while not all are supported.

Value	User Status Byte	Conformance
1	Occupied / Enabled (Access Given)	M
3	Occupied / Disabled	M

User Type: The values are the same as used for “Set PIN Code.”

Return status is a global status code or a cluster-specific status code from the [DoorLockStatus](#) table and SHALL be one of the following values:

Name	Description
SUCCESS	Setting RFID code was successful.
FAILURE	Setting RFID code failed.
CONSTRAINT_ERROR	Setting RFID code failed because User ID requested was out of range.
DUPLICATE	Setting RFID code failed because it would create a duplicate RFID code.

5.2.4.30. Get RFID Code Command

Retrieve an RFID code. User ID is between 0 - [# of RFID Users Supported attribute].

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M

5.2.4.31. Get RFID Code Response Command

Returns the RFID code for the specified user ID.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	User ID	uint16	desc			M
1	User Status	enum8	UserStatusEnum	X	Available	M
2	User Type	enum8	UserTypeEnum	X		M
3	RFID Code	octstr		X	empty	M

If the requested User ID is valid and the Code doesn't exist, Get RFID Code Response SHALL have the following format:

User ID = requested User ID

UserStatus = 0 (available)

UserType = 0xFF (not supported)

RFID Code = 0 (zero length)

If requested User ID is invalid, send Default Response with an error status. The error status shall be equal to CONSTRAINT_ERROR when User_ID is less than the max number of users supported, and NOT_FOUND if greater than or equal to the max number of users supported.

5.2.4.32. Clear RFID Code Command

Clear an RFID code or all RFID codes.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	RFIDSlotIndex	uint16	1 to NumberOfRFIDUsersSupported, 0xFFFF			M

† The User ID is an obsolete field name, use RFIDSslotIndex instead.

For each RFID Code cleared whose user doesn't have a PIN Code or other credential type, then the corresponding user record's UserStatus value SHALL be set to Available, and UserType value SHALL be set to UnrestrictedUser and all schedules SHALL be cleared.

5.2.4.32.1. RFIDSslotIndex

Specifies a valid RFID code slot index or 0xFFFF to indicate all RFID code slots SHALL be cleared.

5.2.4.33. Clear All RFID Codes Command

Clear out all RFIDs on the lock. If you clear all RFID codes and this user didn't have a PIN code, the user status has to be set to "0 Available", the user type has to be set to the default value, and all schedules which are supported have to be set to the default values.

5.2.4.34. Set User Command

Set User into the lock.

Id	Field	Type	Constraint	Quality	Default	Confor- mance
0	Opera- tionType	DataOperationType-Enum	Add, Modify			M
1	UserIndex	uint16	1 to NumberOfTotalUsersSupported			M
2	UserName	string	max 10	X	empty	M
3	UserUniqueID	uint32	all	X	0xFFFFFFFF	M
4	UserStatus	UserStatusEnum	OccupiedEnabled, OccupiedDisabled	X	OccupiedEnabled	M
5	UserType	UserTypeEnum	UnrestrictedUser, NonAccessUser, ForcedUser, DisposableUser, ExpiringUser, ScheduleRestrictedUser, RemoteOnlyUser	X	UnrestrictedUser	M
6	Credential- Rule	Credential- RuleEnum	desc	X	Single	M

Fields used for different use cases:

Use Case	Description
Create a new user record	<ul style="list-style-type: none"> • OperationType SHALL be set to Add. • UserIndex value SHALL be set to a user record with UserType set to Available. • UserName MAY be null causing new user record to use empty string for UserName otherwise UserName SHALL be set to the value provided in the new user record. • UserUniqueID MAY be null causing new user record to use 0xFFFFFFFF for UserUniqueID otherwise UserUniqueID SHALL be set to the value provided in the new user record. • UserStatus MAY be null causing new user record to use OccupiedEnabled for UserStatus otherwise UserStatus SHALL be set to the value provided in the new user record. • UserType MAY be null causing new user record to use UnrestrictedUser for UserType otherwise UserType SHALL be set to the value provided in the new user record. • CredentialRule MAY be null causing new user record to use Single for CredentialRule otherwise CredentialRule SHALL be set to the value provided in the new user record. <p>CreatorFabricIndex and LastModifiedFabricIndex in the new user record SHALL be set to the accessing fabric index.</p> <p>A LockUserChange event SHALL be generated after successfully creating a new user.</p>

Use Case	Description
Modify an existing user record	<ul style="list-style-type: none"> • OperationType SHALL be set to Modify. • UserIndex value SHALL be set for a user record with UserType NOT set to Available. • UserName SHALL be null if modifying a user record that was not created by the accessing fabric. • INVALID_COMMAND SHALL be returned if UserName is not null and the accessing fabric index doesn't match the CreatorFabricIndex in the user record otherwise UserName SHALL be set to the value provided in the user record. • UserUniqueID SHALL be null if modifying the user record that was not created by the accessing fabric. • INVALID_COMMAND SHALL be returned if UserUniqueID is not null and the accessing fabric index doesn't match the CreatorFabricIndex in the user record otherwise UserUniqueID SHALL be set to the value provided in the user record. • UserStatus MAY be null causing no change to UserStatus in user record otherwise UserStatus SHALL be set to the value provided in the user record. • UserType MAY be null causing no change to UserType in user record otherwise UserType SHALL be set to the value provided in the user record. • CredentialRule MAY be null causing no change to CredentialRule in user record otherwise CredentialRule SHALL be set to the value provided in the user record. <p>CreatorFabricIndex SHALL NOT be changed in the user record. LastModifiedFabricIndex in the new user record SHALL be set to the accessing fabric index.</p> <p>A LockUserChange event SHALL be generated after successfully modifying a user.</p>

Return status is a global status code or a cluster-specific status code from the [DoorLockStatus](#) table

and SHALL be one of the following values:

- SUCCESS, if setting User was successful.
- FAILURE, if some unexpected internal error occurred setting User.
- OCCUPIED, if OperationType is Add and UserIndex points to an occupied slot.
- INVALID_COMMAND, if one or more fields violate constraints or are invalid or if OperationType is Modify and UserIndex points to an available slot.

5.2.4.34.1. **UserName**

A string to use as a human readable identifier for the user.

If UserName is null then:

- If the OperationType is Add, the UserName in the resulting user record SHALL be set to an empty string.
- If the OperationType is Modify, the UserName in the user record SHALL NOT be changed from the current value.

If UserName is not null, the UserName in the user record SHALL be set to the provided value.

5.2.4.34.2. **UserUniqueID**

A fabric assigned number to use for connecting this user to other users on other devices from the fabric's perspective.

If UserUniqueID is null then:

- If the OperationType is Add, the UserUniqueID in the resulting user record SHALL be set to default value specified above.
- If the OperationType is Modify, the UserUniqueID in the user record SHALL NOT be changed from the current value.

If UserUniqueID is not null, the UserUniqueID in the user record SHALL be set to the provided value.

5.2.4.34.3. **UserStatus**

A UserStatus to assign to this user when created or modified.

If UserStatus is null then:

- If the OperationType is Add, the UserStatus in the resulting user record SHALL be set to default value specified above.
- If the OperationType is Modify, the UserStatus in the user record SHALL NOT be changed from the current value.

If UserStatus is not null, the UserStatus in the user record SHALL be set to the provided value.

5.2.4.34.4. UserType

A UserType to assign to this user when created or modified.

If UserType is null then:

- If the OperationType is Add, the UserType in the resulting user record SHALL be set to default value specified above.
- If the OperationType is Modify, the UserType in the user record SHALL NOT be changed from the current value.

If UserType is not null, the UserType in the user record SHALL be set to the provided value.

5.2.4.34.5. CredentialRule

The CredentialRule to use for this user.

The valid CredentialRule enumeration values depends on the bits in the [CredentialRulesSupport](#) map. Each bit in the map identifies a valid CredentialRule that can be used.

If CredentialRule is null then:

- If the OperationType is Add, the CredentialRule in the resulting user record SHALL be set to default value specified above.
- If the OperationType is Modify, the CredentialRule in the user record SHALL NOT be changed from the current value.

If CredentialRule is not null, the CredentialRule in the user record SHALL be set to the provided value.

5.2.4.35. Get User Command

Retrieve User.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	UserIndex	uint16	1 to NumberOfTotalUsersSupported			M

An InvokeResponse command SHALL be sent with an appropriate error (e.g. FAILURE, INVALID_COMMAND, etc.) as needed otherwise the [Get User Response Command](#) SHALL be sent implying a status of SUCCESS.

5.2.4.36. Get User Response Command

Returns the User for the specified UserIndex.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	UserIndex	uint16	1 to NumberOfTotalUsersSupported			M
1	UserName	string	max 10	X	empty	M
2	UserUniqueID	uint32	all	X	0	M
3	UserStatus	UserStatusEnum	all	X	Available	M
4	UserType	UserTypeEnum	all	X	UnrestrictedUser	M
5	Credential-Rule	CredentialRuleEnum	CredentialRulesSupport	X	Single	M
6	Credentials	list[CredentialStruct]	0 to NumberOfCredentialsSupportedPerUser	X		M
7	Creator-FabricIndex	fabric-idx	all	X		M
8	LastModified-FabricIndex	fabric-idx	all	X		M
9	NextUserIndex	uint16	1 to NumberOfTotalUsersSupported	X		M

If the requested UserIndex is valid and the UserStatus is Available for the requested UserIndex then UserName, UserUniqueID, UserStatus, UserType, CredentialRule, Credentials, CreatorFabricIndex, and LastModifiedFabricIndex SHALL all be null in the response.

5.2.4.36.1. CreatorFabricIndex

The user's creator fabric index. CreatorFabricIndex SHALL be null if UserStatus is set to Available or when the creator fabric cannot be determined (for example, when user was created outside the Interaction Model) and SHALL NOT be null otherwise. This value SHALL be set to **0** if the original creator fabric was deleted.

5.2.4.36.2. LastModifiedFabricIndex

The user's last modifier fabric index. LastModifiedFabricIndex SHALL be null if UserStatus is set to Available or when the modifier fabric cannot be determined (for example, when user was modified outside the Interaction Model) and SHALL NOT be null otherwise. This value SHALL be set to **0** if the last modifier fabric was deleted.

5.2.4.36.3. NextUserIndex

The next occupied UserIndex in the database which is useful for quickly identifying occupied user slots in the database. This SHALL NOT be null if there is at least one occupied entry after the requested UserIndex in the User database and SHALL be null if there are no more occupied entries.

5.2.4.37. Clear User Command

Clears a User or all Users.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	UserIndex	uint16	1 to NumberOfTotalUsersSupported, 0xFFFFE			M

For each User to clear, all associated credentials (e.g. PIN, RFID, fingerprint, etc.) SHALL be cleared and the User entry values SHALL be reset to their default values (e.g. UserStatus SHALL be Available, UserType SHALL be UnrestrictedUser) and all associated schedules SHALL be cleared.

A LockUserChange event with the provided UserIndex SHALL be generated after successfully clearing users.

5.2.4.37.1. UserIndex

Specifies a valid User index or 0xFFFFE to indicate all User slots SHALL be cleared.

5.2.4.38. Operation Event Notification Command

The door lock server sends out operation event notification when the event is triggered by the various event sources. The specific operation event will only be sent out if the associated bitmask is enabled in the various attributes in the Event Masks Attribute Set.

All events are optional.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Operation Event Source	uint8	desc			M

Id	Field	Type	Constraint	Quality	Default	Conformance
1	Operation Event Code	uint8	desc			M
2	User ID	uint16	desc			M
3	PIN	octstr				M
4	LocalTime	epoch-s	all			M
5	Data	string				O

5.2.4.38.1. Operation Event Sources

This field indicates where the event was triggered from.

Value	Source
0	Keypad
1	Remote
2	Manual
3	RFID
0xFF	Indeterminate

5.2.4.38.2. Operation Event Codes

The door lock optionally sends out notifications (if they are enabled) whenever there is a significant operational event on the lock. When combined with a source from the Event Source table above, the following operational event codes constitute an event on the door lock that can be both logged and sent to a bound device using the Operation Event Notification command.

Not all operation event codes are applicable to each of the event source. The following table marks each event code with “A” if the event code is applicable to the event source.

Value	Name	Conformance	Applicable			
			Keypad	Remote	Manual	RFID
0	UnknownOrMfgSpecific	O	A	A	A	A
1	Lock	O	A	A	A	A
2	Unlock	O	A	A	A	A
3	LockFailureInvalidPINorRFID	O	A	A		A

Value	Name	Conformance	Applicable			
4	LockFailureInvalidSchedule	O	A	A		A
5	UnlockFailureInvalidPINorRFID	O	A	A		A
6	UnlockFailureInvalidSchedule	O	A	A		A
7	One-TouchLock	O			A	
8	KeyLock	O			A	
9	KeyUnlock	O			A	
10	AutoLock	O			A	
11	Schedule-Lock	WDSCH YDS CH			A	
12	ScheduleUnlock	WDSCH YDS CH			A	
13	Manual Lock (Key or Thumb-turn)	O			A	
14	Manual Unlock (Key or Thumb-turn)	O			A	
15	Non-access User Operation Event	O	A			

5.2.4.38.3. User ID

The User ID who performed the event.

5.2.4.38.4. PIN

The PIN that is associated with the User ID who performed the event.

5.2.4.38.5. LocalTime

The time when the event was triggered in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value. If time is not supported, the

field SHALL be populated with default not used value 0xFFFFFFFF.

5.2.4.38.6. Data

The operation event notification command contains a variable string, which can be used to pass data associated with a particular event. Generally this field will be left empty. However, manufacturer can choose to use this field to store/display manufacturer-specific information.

5.2.4.38.7. Keypad Operation Event Notification

Keypad Operation Event Notification feature is enabled by setting the associated bitmasks in the [Keypad Operation Event Mask attribute].

5.2.4.38.8. Remote Operation Event Notification

Remote Operation Event Notification feature is enabled by setting the associated bitmasks in the [Remote Operation Event Mask attribute].

5.2.4.38.9. Manual Operation Event Notification

Manual Operation Event Notification feature is enabled by setting the associated bitmasks in the [Manual Operation Event Mask attribute] attribute.

5.2.4.38.10. RFID Operation Event Notification

RFID Operation Event Notification feature is enabled by setting the associated bitmasks in the [RFID Operation Event Mask attribute].

5.2.4.39. Programming Event Notification Command

The door lock server sends out a programming event notification whenever a programming event takes place on the door lock.

As with operational events, all programming events can be turned on and off by flipping bits in the associated event mask.

The programming event notification command includes an optional string of data that can be used by the manufacturer to pass some manufacturer-specific information if that is required.

Id	Field	Type	Constraint	Quality	Default	Confor- mance
0	Program Event Source	uint8	desc			M
1	Program Event Code	uint8	desc			M
2	User ID	uint16	desc			M
3	PIN	octstr				M
4	User Type	enum8	desc			M

Id	Field	Type	Constraint	Quality	Default	Conformance
5	User Status	enum8	desc			M
6	LocalTime	epoch-s	all			M
7	Data	string				O

5.2.4.39.1. Operation Event Sources

This field indicates where the event was triggered from.

Value	Source
0	Keypad
1	Remote
2	Reserved (Manual in Operation Event)
3	RFID
0xFF	Indeterminate

5.2.4.39.2. Programming Event Codes

The door lock optionally sends out notifications (if they are enabled) whenever there is a significant programming event on the lock. When combined with a source from the Event Source table above, the following programming event codes constitute an event on the door lock that can be both logged and sent to a bound device using the Programming Event Notification command.

Not all event codes are applicable to each of the event source. The following table marks each event code with “A” if the event code is applicable to the event source.

Value	Programming Event Code	Keypad	Remote	RFID
0	UnknownOrMfgSpecific	A	A	A
1	ProgrammingCodeChanged	A		
2	PINCodeAdded	A	A	
3	PINCodeCleared	A	A	
4	PINCodeChanged	A	A	
5	RFIDCodeAdded			A
6	RFIDCodeCleared			A

5.2.4.39.3. User ID

The User ID who performed the event

5.2.4.39.4. PIN

The PIN that is associated with the User ID who performed the event

5.2.4.39.5. User Type

The User Type that is associated with the User ID who performed the event

5.2.4.39.6. User Status

The User Status that is associated with the User ID who performed the event

5.2.4.39.7. LocalTime

The time when the event was triggered in Epoch Time in Seconds with local time offset based on the local timezone and DST offset on the day represented by the value. If time is not supported, the field SHALL be populated with default not used value 0xFFFFFFFF.

5.2.4.39.8. Data

The programming event notification command contains a variable string, which can be used to pass data associated with a particular event. Generally this field will be left empty. However, manufacturer can choose to use this field to store/display manufacturer-specific information.

5.2.4.39.9. Keypad Programming Event Notification

Keypad Programming Event Notification feature is enabled by setting the associated bitmasks in the [Keypad Programming Event Mask attribute].

5.2.4.39.10. Remote Programming Event Notification

Remote Programming Event Notification feature is enabled by setting the associated bitmasks in the [Remote Programming Event Mask attribute].

5.2.4.39.11. RFID Programming Event Notification

RFID Programming Event Notification feature is enabled by setting the associated bitmasks in the [RFID Programming Event Mask attribute].

5.2.4.40. Set Credential Command

Set a credential (e.g. PIN, RFID, Fingerprint, etc.) into the lock for a new user, existing user, or ProgrammingUser.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	OperationType	DataOperationTypeEnum	Add, Modify			M
1	Credential	CredentialStruct				M

Id	Field	Type	Constraint	Quality	Default	Confor-mance
2	Credential-Data	octstr	desc			M
3	UserIndex	uint16	1 to Num-berOfTo-talUsersSup-ported	X		M
4	UserStatus	UserSta-tusEnum	OccupiedEn-abled, Occu-piedDisabled	X	OccupiedEn-abled	M
5	UserType	UserType-Enum	Unrestrict-edUser, Pro-grammin-gUser, NonAcces-sUser, Force-dUser, Dis-posableUser, ExpiringUser , RemoteOn-lyUser	X	Unrestrict-edUser	M

Fields used for different use cases:

Use Case	Description
Create a new credential and a new user record	<ul style="list-style-type: none"> • OperationType SHALL be set to Add. • UserIndex SHALL be set to null and the lock will find a user record with a UserStatus value of Available and associate its UserIndex with the CredentialIndex in CredentialStruct provided. • CredentialIndex in CredentialStruct SHALL be for an unoccupied credential slot. • UserStatus MAY be null. If it is null, the new user record SHALL have UserStatus set to OccupiedEnabled. Otherwise the new user record SHALL have UserStatus set to the provided value. • UserType MAY be null. If it is null, the new user record SHALL have UserType set to UnrestrictedUser. Otherwise the new user record SHALL have UserType set to the provided value. • UserType SHALL NOT be set to ProgrammingUser for this use case. <p>CreatorFabricIndex and LastModifiedFabricIndex in new user and credential records SHALL be set to the accessing fabric index.</p> <p>A LockUserChange event SHALL be generated after successfully creating a new credential and a new user. The UserIndex of this LockUserChange event SHALL be the UserIndex that was used to create the user. The DataIndex of this LockUserChange event SHALL be the CredentialIndex that was used to create the credential.</p>

Use Case	Description
Add a new credential to existing user record	<ul style="list-style-type: none"> • OperationType SHALL be set to Add. • UserIndex SHALL NOT be null and SHALL NOT already be associated with the CredentialIndex in CredentialStruct provided otherwise INVALID_COMMAND status response SHALL be returned. • INVALID_COMMAND SHALL be returned if the accessing fabric index doesn't match the CreatorFabricIndex in the user record pointed to by UserIndex. • CredentialIndex in CredentialStruct provided SHALL be for an available credential slot. • UserStatus SHALL be null. • UserType SHALL be null. <p>CreatorFabricIndex SHALL NOT be changed in the user record. LastModifiedFabricIndex in the user record SHALL be set to the accessing fabric index.</p> <p>CreatorFabricIndex and LastModifiedFabricIndex in the new credential record SHALL be set to the accessing fabric index.</p> <p>A LockUserChange event SHALL be generated after successfully adding a new credential.</p>

Use Case	Description
Modify credential for an existing user record	<ul style="list-style-type: none"> • OperationType SHALL be set to Modify. • UserIndex value SHALL already be associated with the CredentialIndex in CredentialStruct provided otherwise INVALID_COMMAND status response SHALL be returned. • INVALID_COMMAND SHALL be returned if the accessing fabric index doesn't match the CreatorFabricIndex in the user record pointed to by UserIndex. • INVALID_COMMAND SHALL be returned if the accessing fabric index doesn't match the CreatorFabricIndex in the credential record pointed to by the CredentialIndex field value of the Credential parameter. • CredentialIndex in CredentialStruct provided SHALL be for an occupied credential slot • UserStatus SHALL be null. • UserType SHALL be null. <p>CreatorFabricIndex SHALL NOT be changed in user and credential records. LastModifiedFabricIndex in user and credential records SHALL be set to the accessing fabric index.</p> <p>A LockUserChange event SHALL be generated after successfully modifying a credential.</p>

Use Case	Description
Modify credential for a Programming User	<ul style="list-style-type: none"> • OperationType SHALL be set to Modify. • UserIndex SHALL be null. • INVALID_COMMAND SHALL be returned if the accessing fabric index doesn't match the CreatorFabricIndex in the credential record pointed to by the CredentialIndex field value of the Credential parameter. • CredentialType in CredentialStruct SHALL be set to ProgrammingPIN. • CredentialIndex in CredentialStruct SHALL be 0. • UserStatus SHALL be null. • UserType SHALL be set to ProgrammingUser. <p>CreatorFabricIndex SHALL NOT be changed in the credential record. LastModifiedFabricIndex in the credential record SHALL be set to the accessing fabric index.</p> <p>A LockUserChange event SHALL be generated after successfully modifying a ProgrammingUser PIN code.</p>

5.2.4.40.1. OperationType

The set credential operation type requested.

5.2.4.40.2. Credential

A credential structure that contains the [CredentialTypeEnum](#) and the credential index (if applicable or 0 if not) to set.

5.2.4.40.3. CredentialData

The credential data to set for the credential being added or modified. The length of the credential data SHALL conform to the limits of the CredentialType specified in the Credential structure otherwise an INVALID_COMMAND status SHALL be returned in the [Set Credential Response Command](#).

5.2.4.40.4. UserIndex

The user index to the user record that corresponds to the credential being added or modified. This SHALL be null if OperationType is add and a new credential and user is being added at the same time.

5.2.4.40.5. UserStatus

The user status to use in the new user record if a new user is being created. This SHALL be null if OperationType is Modify. This MAY be null when adding a new credential and user.

5.2.4.40.6. UserType

The user type to use in the new user record if a new user is being created. This SHALL be null if OperationType is Modify. This MAY be null when adding a new credential and user.

5.2.4.41. Set Credential Response Command

Returns the status for setting the specified credential.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Status	status	desc			M
1	UserIndex	uint16	1 to NumberOfTotalUsersSupported	X	0	M
2	NextCredentialIndex	uint16	desc	X		O

5.2.4.41.1. Status

Status comes from the [DoorLockStatus](#) table and SHALL be one of the following values:

- SUCCESS, if setting user credential was successful.
- FAILURE, if some unexpected internal error occurred setting user credential.
- OCCUPIED, if OperationType is Add and CredentialIndex in Credential structure points to an occupied slot.
- OCCUPIED, if OperationType is Modify and CredentialIndex in Credential structure does not match the CredentialIndex that is already associated with the provided UserIndex.
- DUPLICATE, if CredentialData provided is a duplicate of another credential (e.g. duplicate PIN code).
- RESOURCE_EXHAUSTED, if OperationType is Add and the user referred to by UserIndex already has NumberOfCredentialsSupportedPerUser credentials associated.
- INVALID_COMMAND, if one or more fields violate constraints or are invalid or if OperationType is Modify and UserIndex points to an available slot.

5.2.4.41.2. UserIndex

The user index that was created with the new credential. If the status being returned is not success then this SHALL be null. This SHALL be null if OperationType was Modify; if the OperationType was Add and a new User was created this SHALL NOT be null and SHALL provide the UserIndex

created. If the OperationType was Add and an existing User was associated with the new credential then this SHALL be null.

5.2.4.41.3. NextCredentialIndex

The next available index in the database for the credential type set, which is useful for quickly identifying available credential slots in the database. This SHALL NOT be null if there is at least one available entry after the requested credential index in the corresponding database and SHALL be null if there are no more available entries. The NextCredentialIndex reported SHALL NOT exceed the maximum number of credentials for a particular credential type.

5.2.4.42. Get Credential Status Command

Retrieve the status of a particular credential (e.g. PIN, RFID, Fingerprint, etc.) by index.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Credential	Credential-Struct				M

An InvokeResponse command SHALL be sent with an appropriate error (e.g. FAILURE, INVALID_COMMAND, etc.) as needed otherwise the [Get Credential Status Response Command](#) SHALL be sent implying a status of SUCCESS.

5.2.4.42.1. Credential

A credential structure that contains the [CredentialTypeEnum](#) and the credential index (if applicable or 0 if not) to retrieve the status for.

5.2.4.43. Get Credential Status Response Command

Returns the status for the specified credential.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	CredentialExists	bool	all			M
1	UserIndex	uint16	1 to NumberOfTotalUsersSupported	X		M
2	Creator-FabricIndex	fabric-idx	all	X		M
3	LastModified-FabricIndex	fabric-idx	all	X		M

Id	Field	Type	Constraint	Quality	Default	Conformance
4	NextCredentialIndex	uint16	desc	X		0

5.2.4.43.1. CredentialExists

A boolean value indicating the requested credential type and index exists and is populated for a given user index.

5.2.4.43.2. UserIndex

The credential's corresponding user index value if the credential exists. If CredentialType requested was ProgrammingUser then UserIndex SHALL be null; otherwise, UserIndex SHALL be null if CredentialExists is set to False and SHALL NOT be null if CredentialExists is set to True.

5.2.4.43.3. CreatorFabricIndex

The credential's creator fabric index. CreatorFabricIndex SHALL be null if CredentialExists is set to False or when the creator fabric cannot be determined (for example, when credential was created outside the Interaction Model) and SHALL NOT be null otherwise. This value SHALL be set to **0** if the original creator fabric was deleted.

5.2.4.43.4. LastModifiedFabricIndex

The credential's last modifier fabric index. LastModifiedFabricIndex SHALL be null if CredentialExists is set to False or when the modifier fabric cannot be determined (for example, when credential was modified outside the Interaction Model) and SHALL NOT be null otherwise. This value SHALL be set to **0** if the last modifier fabric was deleted.

5.2.4.43.5. NextCredentialIndex

The next occupied index in the database for the credential type requested, which is useful for quickly identifying occupied credential slots in the database. This SHALL NOT be null if there is at least one occupied entry after the requested credential index in the corresponding database and SHALL be null if there are no more occupied entries. The NextCredentialIndex reported SHALL NOT exceed the maximum number of credentials for a particular credential type.

5.2.4.44. Clear Credential Command

Clear one, one type, or all credentials except ProgrammingPIN credential.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Credential	Credential-Struct	desc	X		M

Fields used for different use cases:

Use Case	Description
Clear a single credential	<ul style="list-style-type: none"> CredentialType in Credential structure SHALL be set to the credential type to be cleared. CredentialType in Credential structure SHALL NOT be set to ProgrammingPIN. CredentialIndex in Credential structure SHALL be set to the credential index to be cleared. <p>A LockUserChange event SHALL be generated after successfully clearing a credential.</p>
Clear all credentials of one type	<ul style="list-style-type: none"> CredentialType in Credential structure SHALL be set to the credential type to be cleared. CredentialType in Credential structure SHALL NOT be set to ProgrammingPIN. CredentialIndex in Credential structure SHALL be set to 0xFFFF to indicate all credentials of that type SHALL be cleared. <p>A single LockUserChange event SHALL be generated after successfully clearing credentials. This event SHALL have DataIndex set to the CredentialIndex in the Credential structure.</p>
Clear all credentials of all types	<ul style="list-style-type: none"> Credential field SHALL be null. <p>The ProgrammingPIN credential SHALL NOT be cleared.</p> <p>For each credential type cleared, a LockUserChange event with the corresponding Lock-DataType SHALL be generated. This event SHALL have DataIndex set to 0xFFFF.</p>

For each credential cleared whose user doesn't have another valid credential, the corresponding user record SHALL be reset back to default values and its UserStatus value SHALL be set to Available and UserType value SHALL be set to UnrestrictedUser and all schedules SHALL be cleared. In this case a LockUserChange event SHALL be generated for the user being cleared.

Return status SHALL be one of the following values:

Name	Description
SUCCESS	Clearing credential(s) was successful.

Name	Description
FAILURE	Some unexpected internal error occurred clearing credential(s).
INVALID_COMMAND	One or more fields violate constraints or are invalid.

5.2.4.44.1. Credential

A credential structure that contains the [CredentialTypeEnum](#) and the credential index (0xFFFF for all credentials or 0 if not applicable) to clear. This SHALL be null if clearing all credential types otherwise it SHALL NOT be null.

5.2.5. Events

This cluster SHALL support these events:

Id	Name	Priority	Access	Conformance
0	DoorLockAlarm	CRITICAL	V	M
1	DoorStateChange	desc	V	DPS
2	LockOperation	desc	V	M
3	LockOperationError	desc	V	M
4	LockUserChange	INFO	V	USR

The Events specified in this cluster are not intended to define the user experience. The events are only intended to define the metadata format used to notify any nodes that have subscribed for updates.

If the DoorState reported in the DoorStateChange event is not DoorClosed then the priority SHALL be CRITICAL; otherwise it MAY be INFO.

If the LockOperationType reported in the LockOperation event is Unlock or ForcedUserEvent then the priority SHALL be CRITICAL; otherwise it MAY be INFO.

If the OperationError reported in the LockOperationError event is DisabledUserDenied or the LockOperationType is Lock the priority SHALL be CRITICAL; otherwise it MAY be INFO.

5.2.5.1. DoorLockAlarm Event

The door lock cluster provides several alarms which can be sent when there is a critical state on the door lock. The alarms available for the door lock cluster are listed in the [AlarmCodeEnum](#) section below.

The data of this event SHALL contain the following information:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	AlarmCode	Alarm-CodeEnum	all			M

5.2.5.1.1. AlarmCode

The alarm code of the event that has happened.

5.2.5.2. DoorStateChange Event

The door lock server sends out a DoorStateChange event when the door lock door state changes.

The data of this event SHALL contain the following information:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	DoorState	DoorStateEnum	all			M

5.2.5.2.1. DoorState

The new door state for this door event.

5.2.5.3. LockOperation Event

The door lock server sends out a LockOperation event when the event is triggered by the various lock operation sources.

The data of this event SHALL contain the following information:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	LockOperationType	LockOperationType-Enum	all			M
1	OperationSource	OperationSourceEnum	all			M
2	UserIndex	uint16	all	X		M
3	FabricIndex	fabric-idx	all	X		M
4	SourceNode	node-id	all	X		M

Id	Field	Type	Constraint	Quality	Default	Conformance
5	Credentials	list[CredentialStruct]	1 to NumberOfCredentialsSupportedPerUser	X		[USR]

5.2.5.3.1. LockOperationType

The type of the lock operation that was performed.

5.2.5.3.2. OperationSource

The source of the lock operation that was performed.

5.2.5.3.3. UserIndex

The lock UserIndex who performed the lock operation. This SHALL be null if there is no user index that can be determined for the given operation source. This SHALL NOT be null if a user index can be determined. In particular, this SHALL NOT be null if the operation was associated with a valid credential.

5.2.5.3.4. FabricIndex

The fabric index of the fabric that performed the lock operation. This SHALL be null if there is no fabric that can be determined for the given operation source. This SHALL NOT be null if the operation source is "Remote".

5.2.5.3.5. SourceNode

The Node ID of the node that performed the lock operation. This SHALL be null if there is no Node associated with the given operation source. This SHALL NOT be null if the operation source is "Remote".

5.2.5.3.6. Credentials

The list of credentials used in performing the lock operation. This SHALL be null if no credentials were involved.

5.2.5.4. LockOperationError Event

The door lock server sends out a LockOperationError event when a lock operation fails for various reasons.

The data of this event SHALL contain the following information:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	LockOperationType	LockOperationType-Enum	all			M
1	OperationSource	OperationSourceEnum	all			M
2	OperationError	OperationErrorEnum	all			M
3	UserIndex	uint16	all	X		M
4	FabricIndex	fabric-idx	all	X		M
5	SourceNode	node-id	all	X		M
6	Credentials	list[CredentialStruct]	1 to NumberOfCredentialsSupportedPerUser	X		[USR]

5.2.5.4.1. LockOperationType

The type of the lock operation that was performed.

5.2.5.4.2. OperationSource

The source of the lock operation that was performed.

5.2.5.4.3. OperationError

The lock operation error triggered when the operation was performed.

5.2.5.4.4. UserIndex

The lock UserIndex who performed the lock operation. This SHALL be null if there is no user id that can be determined for the given operation source.

5.2.5.4.5. FabricIndex

The fabric index of the fabric that performed the lock operation. This SHALL be null if there is no fabric that can be determined for the given operation source. This SHALL NOT be null if the operation source is "Remote".

5.2.5.4.6. SourceNode

The Node ID of the node that performed the lock operation. This SHALL be null if there is no Node associated with the given operation source. This SHALL NOT be null if the operation source is

"Remote".

5.2.5.4.7. Credentials

The list of credentials used in performing the lock operation. This SHALL be null if no credentials were involved.

5.2.5.5. LockUserChange Event

The door lock server sends out a LockUserChange event when a lock user, schedule, or credential change has occurred.

The data of this event SHALL contain the following information:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Lock- DataType	Lock- DataType- Enum	all			M
1	DataOpera- tionType	DataOpera- tionType- Enum	all			M
2	Opera- tionSource	Opera- tionSourceE num	Unspecified, Keypad, Remote			M
3	UserIndex	uint16	all	X		M
4	FabricIndex	fabric-idx	all	X		M
5	SourceNode	node-id	all	X		M
6	DataIndex	uint16	all	X		M

5.2.5.5.1. LockDataType

The lock data type that was changed.

5.2.5.5.2. DataOperationType

The data operation performed on the lock data type changed.

5.2.5.5.3. OperationSource

The source of the user data change.

5.2.5.5.4. UserIndex

The lock UserIndex associated with the change (if any). This SHALL be null if there is no specific user associated with the data operation. This SHALL be 0xFFFF if all users are affected (e.g. Clear Users).

5.2.5.5.5. FabricIndex

The fabric index of the fabric that performed the change (if any). This SHALL be null if there is no fabric that can be determined to have caused the change. This SHALL NOT be null if the operation source is "Remote".

5.2.5.5.6. SourceNode

The Node ID that performed the change (if any). The Node ID of the node that performed the change. This SHALL be null if there was no Node involved in the change. This SHALL NOT be null if the operation source is "Remote".

5.2.5.5.7. DataIndex

This is the index of the specific item that was changed (e.g. schedule, PIN, RFID, etc.) in the list of items identified by LockDataType. This SHALL be null if the LockDataType does not correspond to a list that can be indexed into (e.g. ProgrammingUser). This SHALL be 0xFFFF if all indices are affected (e.g. Clear PIN Code, Clear RFID Code, Clear Week Day Schedule, Clear Year Day Schedule, etc.).

5.2.6. Data Types

5.2.6.1. AlarmCodeEnum

The Alarm Code enum SHALL indicate the alarm type. The data type of the Alarm Code enum is derived from enum8.

Value	Name	Conformance	Description
0	LockJammed	M	Locking Mechanism Jammed
1	LockFactoryReset	O	Lock Reset to Factory Defaults
3	LockRadioPowerCycled	O	Lock Radio Power Cycled
4	WrongCodeEntryLimit	[USR]	Tamper Alarm - wrong code entry limit
5	FrontEsceutcheonRemoved	O	Tamper Alarm - front escutcheon removed from main
6	DoorForcedOpen	[DPS]	Forced Door Open under Door Locked Condition
7	DoorAjar	[DPS]	Door ajar
8	ForcedUser	[USR]	Force User SOS alarm

5.2.6.2. CredentialRuleEnum

The CredentialRule enum used in various commands SHALL indicate the credential rule that can be applied to a particular user. The data type of the CredentialRule enum is derived from enum8.

Value	Name	Conformance	Definition
0	Single	USR	Only one credential is required for lock operation
1	Dual	[USR]	Any two credentials are required for lock operation
2	Tri	[USR]	Any three credentials are required for lock operation

5.2.6.3. CredentialStruct

The CredentialStruct is used in LockOperation event and Get User Record Response command and SHALL indicate the credential types and their corresponding indices (if any) for the event or user record.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Credential-Type	CredentialTypeEnum	all			M
1	CredentialIndex	uint16	all		0	M

5.2.6.3.1. CredentialType

The credential type used to authorize the lock operation.

5.2.6.3.2. CredentialIndex

This is the index of the specific credential used to authorize the lock operation in the list of credentials identified by CredentialType (e.g. schedule, PIN, RFID, etc.). This SHALL be set to 0 if CredentialType is ProgrammingPIN or does not correspond to a list that can be indexed into.

5.2.6.4. CredentialTypeEnum

The Credential Type enum SHALL indicate the credential type. The data type of the Credential Type enum is derived from enum8.

Value	Name	Conformance	Definition
0	ProgrammingPIN	O	Programming PIN code credential type

Value	Name	Conformance	Definition
1	PIN	PIN	PIN code credential type
2	RFID	RID	RFID identifier credential type
3	Fingerprint	FGP	Fingerprint identifier credential type
4	FingerVein	FGP	Finger vein identifier credential type
5	Face	FACE	Face identifier credential type

5.2.6.5. DataOperationTypeEnum

The DataOperationType enum SHALL indicate the data operation performed. The data type of the DataOperationType enum is derived from enum8.

Value	Name	Conformance	Description
0	Add	M	Data is being added or was added
1	Clear	M	Data is being cleared or was cleared
2	Modify	M	Data is being modified or was modified

5.2.6.6. DaysMaskMap

The DaysMask field used in various commands and SHALL indicate the days of the week the Week Day schedule applies for. The data type of the DaysMask field is derived from map8.

Bit	Description	Default	Conformance
0	Sunday		M
1	Monday		M
2	Tuesday		M
3	Wednesday		M
4	Thursday		M
5	Friday		M
6	Saturday		M

5.2.6.7. DoorStateEnum

The DoorState enumeration SHALL indicate the current door state. The data type of the DoorState

enum field is derived from enum8.

Value	Name	Conformance	Description
0	DoorOpen	DPS	Door state is open
1	DoorClosed	DPS	Door state is closed
2	DoorJammed	[DPS]	Door state is jammed
3	DoorForcedOpen	[DPS]	Door state is currently forced open
4	DoorUnspecifiedError	[DPS]	Door state is invalid for unspecified reason
5	DoorAjar	[DPS]	Door state is ajar

5.2.6.8. DoorLockStatus

The cluster-specific status codes for the Door Lock cluster are as follows:

Value	Status Code	Description
2	DUPLICATE	Entry would cause a duplicate credential/ID.
3	OCCUPIED	Entry would replace an occupied slot.

5.2.6.8.1. DUPLICATE

The provided User ID, PIN or RFID code or other credential is a duplicate of an existing entry.

5.2.6.8.2. OCCUPIED

The provided User ID, Credential ID, or entry location is already occupied. The entry might need to be deleted or a different ID or location chosen.

5.2.6.9. LockDataTypeEnum

The LockDataType enum SHALL indicate the data type that is being or has changed. The data type of the DataType enum is derived from enum8.

Value	Name	Conformance	Description
0	Unspecified	O	Unspecified or manufacturer specific lock user data added, cleared, or modified.
1	ProgrammingCode	O	Lock programming PIN code was added, cleared, or modified.

Value	Name	Conformance	Description
2	UserIndex	M	Lock user index was added, cleared, or modified.
3	WeekDaySchedule	WDSCH	Lock user week day schedule was added, cleared, or modified.
4	YearDaySchedule	YDSCH	Lock user year day schedule was added, cleared, or modified.
5	HolidaySchedule	HDSCH	Lock holiday schedule was added, cleared, or modified.
6	PIN	PIN	Lock user PIN code was added, cleared, or modified.
7	RFID	RID	Lock user RFID code was added, cleared, or modified.
8	Fingerprint	FGP	Lock user fingerprint was added, cleared, or modified.
9	FingerVein	FGP	Lock user finger-vein information was added, cleared, or modified.
10	Face	FACE	Lock user face information was added, cleared, or modified.

5.2.6.10. LockOperationTypeEnum

The LockOperationType enumeration SHALL indicate the type of Lock operation performed. The data type of the LockOperationType enum field is derived from enum8.

Value	Name	Conformance	Definition
0	Lock	M	Lock operation
1	Unlock	M	Unlock operation
2	NonAccessUserEvent	O	Triggered by keypad entry for user with User Type set to Non Access User

Value	Name	Conformance	Definition
3	ForcedUserEvent	O	Triggered by using a user with UserType set to Forced User

5.2.6.11. OperationErrorEnum

The OperationError enumeration SHALL indicate the error cause of the Lock/Unlock operation performed. The data type of the OperationError enum field is derived from enum8.

Value	Name	Conformance	Definition
0	Unspecified	O	Lock/unlock error caused by unknown or unspecified source
1	InvalidCredential	USR	Lock/unlock error caused by invalid PIN, RFID, fingerprint or other credential
2	DisabledUserDenied	M	Lock/unlock error caused by disabled USER or credential
3	Restricted	WDSCH YDSCH	Lock/unlock error caused by schedule restriction
4	InsufficientBattery	O	Lock/unlock error caused by insufficient battery power left to safely actuate the lock

5.2.6.12. OperatingModeEnum

The OperatingMode enumeration SHALL indicate the lock operating mode. The data type of the OperatingMode enum field is derived from enum8.

The table below shows the operating mode and which interfaces are enabled, if supported, for each mode.

Value	Name	Conformance	Interface Operational (Y = Yes; N = No)		
			Keypad	Remote	RFID
0	Normal	M	Y	Y	Y
1	Vacation	O	N	Y	N
2	Privacy	O	N	N	N
3	NoRemote-LockUnlock	M	Y	N	Y

Value	Name	Conformance	Interface Operational (Y = Yes; N = No)		
4	Passage	O	N/A	N/A	N/A

Note: For modes that disable the remote interface, the door lock SHALL respond to Lock, Unlock, Toggle, and Unlock with Timeout commands with a response status Failure and not take the action requested by those commands. The door lock SHALL NOT disable the radio or otherwise unbind or leave the network. It SHALL still respond to all other commands and requests.

5.2.6.12.1. Normal

The lock operates normally. All interfaces are enabled.

5.2.6.12.2. Vacation

Only remote interaction is enabled. The keypad SHALL only be operable by the master user.

5.2.6.12.3. Privacy

This mode is only possible if the door is locked. Manual unlocking changes the mode to Normal operating mode. All external interaction with the door lock is disabled. This mode is intended to be used so that users, presumably inside the property, will have control over the entrance.

5.2.6.12.4. NoRemoteLockUnlock

This mode only disables remote interaction with the lock. This does not apply to any remote proprietary means of communication. It specifically applies to the Lock, Unlock, Toggle, and Unlock with Timeout Commands.

5.2.6.12.5. Passage

The lock is open or can be opened or closed at will without the use of a Keypad or other means of user validation (e.g. a lock for a business during work hours).

5.2.6.13. OperationSourceEnum

The OperationSource enumeration SHALL indicate the source of the Lock/Unlock operation performed. The data type of the OperationSource enum field is derived from enum8.

Value	Name	Conformance	Definition
0	Unspecified	O	Lock/unlock operation came from unspecified source
1	Manual	O	Lock/unlock operation came from manual operation (key, thumb-turn, handle, etc).

Value	Name	Conformance	Definition
2	ProprietaryRemote	O	Lock/unlock operation came from proprietary remote source (e.g. vendor app/cloud)
3	Keypad	O	Lock/unlock operation came from keypad
4	Auto	O	Lock/unlock operation came from lock automatically (e.g. relock timer)
5	Button	O	Lock/unlock operation came from lock button (e.g. one touch or button)
6	Schedule	HDSCH	Lock/unlock operation came from lock due to a schedule
7	Remote	M	Lock/unlock operation came from remote node
8	RFID	RID	Lock/unlock operation came from RFID card
9	Biometric	[USR]	Lock/unlock operation came from biometric source (e.g. face, fingerprint/fingervein)

5.2.6.14. PIN/RFID Code Format

The PIN/RFID codes defined in this specification are all octet strings.

All value in the PIN/RFID code SHALL be ASCII encoded regardless if the PIN/RFID codes are number or characters. For example, code of “1, 2, 3, 4” SHALL be represented as 0x31, 0x32, 0x33, 0x34.

5.2.6.15. UserStatusEnum

The UserStatus enum used in various commands SHALL indicate what the status is for a specific user ID.

Enum	Description	Conformance
0	Available	M
1	OccupiedEnabled	M
3	OccupiedDisabled	O

5.2.6.16. UserTypeEnum

The UserType enum used in various commands SHALL indicate what the type is for a specific user ID.

Enum	Description	Conformance
0	UnrestrictedUser	M
1	YearDayScheduleUser	O
2	WeekDayScheduleUser	O
3	ProgrammingUser	O
4	NonAccessUser	O
5	ForcedUser	[USR]
6	DisposableUser	[USR]
7	ExpiringUser	[USR]
8	ScheduleRestrictedUser	WDSCH YDSCH
9	RemoteOnlyUser	USR & COTA & PIN

5.2.6.16.1. UnrestrictedUser

User has access 24/7 provided proper PIN or RFID is supplied (e.g., owner).

5.2.6.16.2. YearDayScheduleUser

User has ability to open lock within a specific time period (e.g., guest).

5.2.6.16.3. WeekDayScheduleUser

User has ability to open lock based on specific time period within a reoccurring weekly schedule (e.g., cleaning worker).

5.2.6.16.4. ProgrammingUser

User has ability to both program and operate the door lock. This user can manage the users and user schedules. In all other respects this user matches the unrestricted (default) user. ProgrammingUser is the only user that can disable the user interface (keypad, remote, etc...).

5.2.6.16.5. NonAccessUser

User is recognized by the lock but does not have the ability to open the lock. This user will only cause the lock to generate the appropriate event notification to any bound devices.

5.2.6.16.6. ForcedUser

User has ability to open lock but a ForcedUser LockOperationType and ForcedUser silent alarm will be emitted to allow a notified Node to alert emergency services or contacts on the user account when used.

5.2.6.16.7. DisposableUser

User has ability to open lock once after which the lock SHALL change the corresponding user record UserStatus value to OccupiedDisabled automatically.

5.2.6.16.8. ExpiringUser

User has ability to open lock for ExpiringUserTimeout attribute minutes after the first use of the PIN code, RFID code, Fingerprint, or other credential. After ExpiringUserTimeout minutes the corresponding user record UserStatus value SHALL be set to OccupiedDisabled automatically by the lock. The lock SHALL persist the timeout across reboots such that the ExpiringUserTimeout is honored.

5.2.6.16.9. ScheduleRestrictedUser

User access is restricted by Week Day and/or Year Day schedule.

5.2.6.16.10. RemoteOnlyUser

User access and PIN code is restricted to remote lock/unlock commands only. This type of user might be useful for regular delivery services or voice assistant unlocking operations to prevent a PIN code credential created for them from being used at the keypad. The PIN code credential would only be provided over-the-air for the lock/unlock commands.

5.3. Window Covering

The window covering cluster provides an interface for controlling and adjusting automatic window coverings such as drapery motors, automatic shades, curtains and blinds.

5.3.1. Revision History

The global *ClusterRevision* attribute value SHALL be the highest revision number in the table below.

Rev	Description
1	mandatory global <i>ClusterRevision</i> attribute added; CCB 1994 1995 1996 1997 2086 2094 2095 2096 2097
2	CCB 2328
3	CCB 2477 2555 2845 3028
4	All Hubs changes with FeatureMap & OperationalStatus attribute
5	New data model format and notation. Created plus clarified Position Aware and Absolute Position features. General cleanup of functionality.

5.3.2. Classification

Hierarchy	Role	PICS Code	Primary Transaction
Base	Application	WNCV	Type 1 (client to server)

5.3.3. Cluster Identifiers

Identifier	Name
0x0102	Window Covering

5.3.4. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Conformance	Summary
0	LF	Lift*	O.a+	Lift Control and behavior for lifting/sliding window coverings
1	TL	Tilt*	O.a+	Tilt Control and behavior for tilting window coverings
2	PA_LF	PositionAwareLift	[LF]	Position Aware lift control is supported.
3	ABS	AbsolutePosition	O	Absolute positioning is supported.
4	PA_TL	PositionAwareTilt	[TL]	Position Aware tilt control is supported.

*At least one of the Lift and Tilt features SHALL be supported.

Due to backward compatibility reasons this feature map SHALL match the advertised Type Attribute Supported Features.

5.3.4.1. Lift

The Lift feature applies to window coverings that lift up and down (ex: for a rollershade, Up and Down is Lift Open and Close) or slide left to right (ex: for a sliding curtain, Left and Right is Lift Open and Close).

5.3.4.2. Tilt

The Tilt feature applies to window coverings with vertical or horizontal strips.

5.3.4.3. Position Aware

Relative positioning with *percent100ths* (min step 0.01%) attribute is mandatory, E.g Max 10000 equals 100.00% and relative positioning with *percent* (min step 1%) attribute is for backward compatibility.

The *CurrentPosition* attributes SHALL always reflect the physical position of an actuator and the *TargetPosition* attribute SHALL reflect the requested position of an actuator once a positioning command is received.

5.3.4.3.1. Position Aware Lift

Relative positioning for Lift attributes and commands.

5.3.4.3.2. Position Aware Tilt

Relative positioning for Tilt attributes and commands.

5.3.4.4. Absolute Position

The percentage attributes SHALL indicate the position as a percentage between the *InstalledOpenLimits* and *InstalledClosedLimits* attributes of the window covering starting at the open (0.00%).

As a general rule, absolute positioning (in centimeters or tenth of a degrees) SHOULD NOT be supported for new implementations.

5.3.5. Attributes

ID	Name	Unit	Type	Con-straint	Qual-ity	Defau-lt	Acces-s	Confor-mance
0x0000 0	Type		enum 8	desc	F	0	R V	M
0x0000 1	PhysicalClosedLimitLift	cm	uint16	all	F	0	R V	[LF & PA_LF & ABS]
0x0000 2	PhysicalClosedLimitTilt	0.1°	uint16	all	F	0	R V	[TL & PA_TL & ABS]
0x0000 3	CurrentPositionLift¹	cm	uint16	InstalledOpenLimitLift to InstalledClosedLimitLift	XN	null	R V	[LF & PA_LF & ABS]

ID	Name	Unit	Type	Con- straint	Qual- ity	Defau lt	Acces s	Confor mance
0x000 4	CurrentPositionTilt¹	0.1°	uint16	Installe dOpen -LimitTilt to Installed -Clos -edLimit -Tilt	XN	null	R V	[TL & PA_TL & ABS]
0x000 5	NumberOfActuationsLift	#	uint16	all	N	0	R V	[LF]
0x000 6	NumberOfActuationsTilt	#	uint16	all	N	0	R V	[TL]
0x000 7	ConfigStatus		map8	desc	N	desc	R V	M
0x000 8	CurrentPositionLiftPer centage¹	1%	per cent	0 to 100	XNSP	null	R V	[LF & PA_LF]
0x000 9	CurrentPositionTiltPercent age¹	1%	per cent	0 to 100	XNSP	null	R V	[TL & PA_TL]
0x000 a	OperationalStatus		map8	00xx xxxx	P	0	R V	M
0x000 b	TargetPositionLiftPer cent100ths²	0.01%	per cent10 0ths	0 to 10000	XSP	null	R V	LF & PA_LF
0x000 c	TargetPositionTiltPer cent100ths²	0.01%	per cent10 0ths	0 to 10000	XSP	null	R V	TL & PA_TL
0x000 d	EndProductType		enum 8	desc	F	0	R V	M
0x000 e	CurrentPositionLiftPer cent100ths¹	0.01%	per cent10 0ths	0 to 10000	XNP	null	R V	LF & PA_LF
0x000 f	CurrentPositionTiltPer cent100ths¹	0.01%	per cent10 0ths	0 to 10000	XNP	null	R V	TL & PA_TL
0x001 0	InstalledOpenLimitLift	cm	uint16	0 to 65534	N	0	R V	LF & PA_LF & ABS
0x001 1	InstalledClosedLimitLift	cm	uint16	0 to 65534	N	65534	R V	LF & PA_LF & ABS

ID	Name	Unit	Type	Constraint	Quality	Default	Access	Conformance
0x0012	InstalledOpenLimitTilt	0.1°	uint16	0 to 65534	N	0	R V	TL & PA_TL & ABS
0x0013	InstalledClosedLimitTilt	0.1°	uint16	0 to 65534	N	65534	R V	TL & PA_TL & ABS
0x0014	VelocityLift							D
0x0015	AccelerationTimeLift							D
0x0016	DecelerationTimeLift							D
0x0017	Mode	-	map8	0000 xxxx	N	0	RW VM	M
0x0018	IntermediateSetpointsLift							D
0x0019	IntermediateSetpointsTilt							D
0x001a	SafetyStatus		map16	desc	P	0	R V	O

For attributes designated with "S" in the Quality column, please see [Scene Table Extensions](#).

NOTE	<i>Nullable positions</i>
	1 - The null value indicates that the current position is unknown, e.g. calibration is needed.
	2 - The null value indicates that the value is unavailable, e.g. no target position has been set.

5.3.5.1. Type Attribute

The Type attribute identifies the type of window covering being controlled by this endpoint and SHALL be set to one of the non-reserved values in the table below.

Value	Type	Supported Features
0x00	Rollershade	Lift
0x01	Rollershade - 2 Motor	Lift
0x02	Rollershade - Exterior	Lift
0x03	Rollershade - Exterior - 2 Motor	Lift

Value	Type	Supported Features
0x04	Drapery (curtain)	Lift
0x05	Awning	Lift
0x06	Shutter	Tilt, Lift
0x07	Tilt Blind - Tilt Only	Tilt
0x08	Tilt Blind - Lift & Tilt	Lift, Tilt
0x09	Projector Screen	Lift
0xFF	Unknown	

5.3.5.2. PhysicalClosedLimitLift Attribute

The PhysicalClosedLimitLift attribute identifies the maximum possible encoder position possible (in centimeters) to position the height of the window covering Lift.

5.3.5.3. PhysicalClosedLimitTilt Attribute

The PhysicalClosedLimitTilt attribute identifies the maximum possible encoder position possible (tenth of a degrees) to position the angle of the window covering Tilt.

5.3.5.4. CurrentPositionLift Attribute

The CurrentPositionLift attribute identifies the actual Lift position (in centimeters) of the window covering from the fully-open position.

5.3.5.5. CurrentPositionTilt Attribute

The CurrentPositionTilt attribute identifies the actual Tilt position (in tenth of an degree) of the window covering from the fully-open position.

5.3.5.6. NumberOfActuationsLift Attribute

The NumberOfActuationsLift attribute identifies the total number of lift/slide actuations applied to the Window Covering since the device was installed.

5.3.5.7. NumberOfActuationsTilt Attribute

The NumberOfActuationsTilt attribute identifies the total number of tilt actuations applied to the Window Covering since the device was installed.

5.3.5.8. ConfigStatus Attribute

The ConfigStatus attribute makes configuration and status information available. To change settings, devices SHALL write to the Mode attribute of the Window Covering Settings Attribute Set. The behavior causing the setting or clearing of each bit is vendor specific. See table below for details on each bit.

Bit	Meaning	Description	M
0	0 = Not Operational 1 = Operational	Operational: This status bit defines if the Window Covering is operational. The <i>SafetyStatus</i> & <i>Mode</i> attributes might affect this bit	M
1	Reserved	<i>deprecated</i>	D
2	0 = Lift movement are normal 1 = Lift movement is reversed	Reversal: This status bit identifies if the directions of the lift/slide movements have been reversed in order for commands (e.g: Open, Close, GoTos) to match the physical installation conditions This bit can be adjusted by setting the appropriate reversal bit value in the <i>Mode</i> attribute	LF
3	0 = Lift control is not Position Aware 1 = Lift control is Position Aware	Control - Lift: This status bit identifies if the window covering supports the Position Aware Lift Control	LF
4	0 = Tilt control is not Position Aware 1 = Tilt control is Position Aware	Control - Tilt: This status bit identifies if the window covering supports the Position Aware Tilt Control	TL
5	0 = Timer Controlled 1 = Encoder Controlled This bit is Ignored if the device does not support the Position Aware for Lift.	Encoder - Lift: This status bit identifies if a Position Aware Controlled Window Covering is employing an encoder for positioning the height of the window covering.	LF & PA_LF
6	0 = Timer Controlled 1 = Encoder Controlled This bit is Ignored if the device does not support the Position Aware for Tilt.	Encoder - Tilt: This status bit identifies if a Position Aware Controlled Window Covering is employing an encoder for tilting the window covering.	TL & PA_TL

5.3.5.9. CurrentPositionLiftPercent100ths Attribute

The CurrentPositionLiftPercent100ths attribute identifies the actual position as a percentage with a minimal step of 0.01%. E.g Max 10000 equals 100.00%.

5.3.5.10. CurrentPositionTiltPercent100ths Attribute

The CurrentPositionTiltPercent100ths attribute identifies the actual position as a percentage with a minimal step of 0.01%. E.g Max 10000 equals 100.00%.

5.3.5.11. CurrentPositionLiftPercentage Attribute

The CurrentPositionLiftPercentage attribute identifies the actual position as a percentage from 0% to 100% with 1% default step. This attribute is equal to CurrentPositionLiftPercent100ths attribute divided by 100.

5.3.5.12. CurrentPositionTiltPercentage Attribute

The CurrentPositionTiltPercentage attribute identifies the actual position as a percentage from 0% to 100% with 1% default step. This attribute is equal to CurrentPositionTiltPercent100ths attribute divided by 100.

5.3.5.13. TargetPositionLiftPercent100ths Attribute

The TargetPositionLiftPercent100ths attribute identifies the position where the Window Covering Lift will go or is moving to as a percentage.

5.3.5.14. TargetPositionTiltPercent100ths Attribute

The TargetPositionTiltPercent100ths attribute identifies the position where the Window Covering Tilt will go or is moving to as a percentage.

5.3.5.15. OperationalStatus Attribute

The OperationalStatus attribute keeps track of currently ongoing operations and applies to all type of devices. See below for details about the meaning of individual bits.

Bit	Meaning	Description
0..1	00b = covering is currently not moving 01b = covering is currently opening 10b = covering is currently closing 11b = reserved	Indicates in which direction the covering is currently moving or if it has stopped. If it is moving from closed to open, the value of this enumeration is 01b; if it is moving from open to closed, the value is 10b; if the covering is currently not moving the value is 00b; the value 11b is reserved.
2..3	00b = covering LF is currently not moving 01b = covering LF is currently opening 10b = covering LF is currently closing 11b = reserved	Indicates in which direction the covering's Lift is currently moving or if it has stopped. If it is moving from closed to open, the value of this enumeration is 01b; if it is moving from open to closed, the value is 10b; if it is currently not moving the value is 00b; the value 11b is reserved.

Bit	Meaning	Description
4..5	00b = covering TL is currently not moving 01b = covering TL is currently opening 10b = covering TL is currently closing 11b = reserved	Indicates in which direction the covering's Tilt is currently moving or if it has stopped. If it is moving from closed to open, the value of this enumeration is 01b; if it is moving from open to closed, the value is 10b; if it is currently not moving the value is 00b; the value 11b is reserved.

5.3.5.16. EndProductType Attribute

The EndProductType attribute identifies the product type in complement of the main category indicated by the Type attribute. The window covering SHALL set this value to one of the values in the table below.

Value	EndProductType	Indoor Out- door	Indica- tive Dimen- sion	Recommended Type & Features
0x00	Roller Shade	I	1D	0x00 Rollershade (Lift)
0x01	Roman Shade	I	1D	0x00 Rollershade (Lift)
0x02	Balloon Shade	I	1D	0x00 Rollershade (Lift)
0x03	Woven Wood	I	1D	0x00 Rollershade (Lift)
0x04	Pleated Shade	I	1D	0x00 Rollershade (Lift)
0x05	Cellular Shade	I	1D	0x00 Rollershade (Lift)
0x06	Layered Shade	I	1D	0x00 Rollershade (Lift)
0x07	Layered Shade 2D	I	2D	0x01 Rollershade - 2 Motor (Lift)
0x08	Sheer Shade	I	2D	0x08 Tilt Blind - Lift & Tilt (Lift, Tilt)
0x09	Tilt Only Interior Blind	I	1D	0x07 Tilt Blind - Tilt Only (Tilt)
0x0a	Interior Blind	I	2D	0x08 Tilt Blind - Lift & Tilt (Lift, Tilt)
0x0b	Vertical Blind, Strip Curtain	I	2D	0x08 Tilt Blind - Lift & Tilt (Lift, Tilt)
0x0c	Interior Venetian Blind	I	2D	0x08 Tilt Blind - Lift & Tilt (Lift, Tilt)
0x0d	Exterior Venetian Blind	O	2D	0x08 Tilt Blind - Lift & Tilt (Lift, Tilt)
0x0e	Lateral Left Curtain	I	1D	0x04 Drapery (Lift)
0x0f	Lateral Right Curtain	I	1D	0x04 Drapery (Lift)
0x10	Central Curtain	I	1D	0x04 Drapery (Lift)
0x11	Roller Shutter	O	1D	0x02 Rollershade - Exterior (Lift)
0x12	Exterior Vertical Screen	O	1D	0x02 Rollershade - Exterior (Lift)

Value	EndProductType	Indoor Out- door	Indica- tive Dimen- sion	Recommended Type & Features
0x13	Awning Terrace (Patio)	O	1D	0x05 Awning (Lift)
0x14	Awning Vertical Screen	O	1D	0x05 Awning (Lift)
0x15	Tilt Only Pergola	O	1D	0x06 Shutter (Tilt)
0x16	Swinging Shutter	O	1D	0x06 Shutter (Lift)
0x17	Sliding Shutter	O	1D	0x06 Shutter (Lift)
0xff	Unknown			

5.3.5.17. InstalledOpenLimitLift Attribute

The InstalledOpenLimitLift attribute identifies the Open Limit for Lifting the Window Covering whether position (in centimeters) is encoded or timed.

5.3.5.18. InstalledClosedLimitLift Attribute

The InstalledClosedLimitLift attribute identifies the Closed Limit for Lifting the Window Covering whether position (in centimeters) is encoded or timed.

5.3.5.19. InstalledOpenLimitTilt Attribute

The InstalledOpenLimitTilt attribute identifies the Open Limit for Tilting the Window Covering whether position (in tenth of a degree) is encoded or timed.

5.3.5.20. InstalledClosedLimitTilt Attribute

The InstalledClosedLimitTilt attribute identifies the Closed Limit for Tilting the Window Covering whether position (in tenth of a degree) is encoded or timed.

5.3.5.21. Mode Attribute

The Mode attribute allows configuration of the Window Covering, such as: reversing the motor direction, placing the Window Covering into calibration mode, placing the motor into maintenance mode, disabling the network, and disabling status LEDs. See below for details.

In the case a device does not support or implement a specific mode, e.g. the device has a specific installation method and reversal is not relevant or the device does not include a maintenance mode, any write interaction to the *Mode attribute*, with an unsupported mode bit or any out of bounds bits set, must be ignored and a response containing the status of CONSTRAINT_ERROR will be returned.

Bit	Meaning	Description
0	0 = Lift movement is normal 1 = Lift movement is reversed	Disables (0) or Enables (1) Lift reversal
1	0 = normal mode 1 = calibration mode	<p>Disabled (0) or Enabled (1) placing the Window Covering into calibration Mode where limits are either setup using tools or learned by the Window Covering by doing self-calibration.</p> <p>If in calibration mode, all commands (e.g: <i>UpOrOpen</i>, <i>DownOrClose</i>, <i>GoTo</i>s) that can result in movement, could be accepted and result in a self-calibration being initiated before the command is executed. In case the Window Covering does not have the ability or is not able to perform a self-calibration, the command SHOULD be ignored and a FAILURE status SHOULD be returned.</p> <p>In a write interaction, setting this bit to 0, while the device is in calibration mode, is not allowed and SHALL generate a FAILURE error status. In order to leave calibration mode, the device must perform its calibration routine, either as a self-calibration or assisted by external tool(s), depending on the device/manufacturer implementation.</p> <p>A manufacturer might choose to set the operational bit to its not operational value, if applicable during calibration mode</p>
2	0 = normal mode 1 = maintenance mode	<p>Disables (0) or Enables (1) placing the Window Covering into Maintenance Mode where it cannot be moved over the network or by a switch connected to a Local Switch Input.</p> <p>While in maintenance mode, all commands (e.g: <i>UpOrOpen</i>, <i>DownOrClose</i>, <i>GoTo</i>s) that can result in movement, must be ignored and respond with a BUSY status. Additionally, the operational bit of the <i>ConfigStatus</i> attribute should be set to its not operational value.</p>
3	0 = LEDs are off 1 = LEDs will display feedback	Disables (0) or Enables (1) the display of any feedback LEDs resident especially on the packaging of an endpoint where they may cause distraction to the occupant.

5.3.5.22. SafetyStatus Attribute

The SafetyStatus attribute reflects the state of the safety sensors and the common issues preventing movements. By default for nominal operation all flags are cleared (0). A device might support none, one or several bit flags from this attribute (all optional). See below for details about the meaning of individual bits.

Bit	State Bit	Description
0	Remote Lockout	Movement commands are ignored (locked out). e.g. not granted authorization, outside some time/date range.
1	Tamper Detection	Tampering detected on sensors or any other safety equipment. Ex: a device has been forcedly moved without its actuator(s).
2	Failed Communication	Communication failure to sensors or other safety equipment.
3	Position Failure	Device has failed to reach the desired position. e.g. with Position Aware device, time expired before TargetPosition is reached.
4	Thermal Protection	Motor(s) and/or electric circuit thermal protection activated.
5	Obstacle Detected	An obstacle is preventing actuator movement.
6	Power	Device has power related issue or limitation e.g. device is running w/ the help of a backup battery or power might not be fully available at the moment.
7	Stop Input	Local safety sensor (not a direct obstacle) is preventing movements (e.g. Safety EU Standard EN60335).
8	Motor Jammed	Mechanical problem related to the motor(s) detected.
9	Hardware Failure	PCB, fuse and other electrics problems.
10	Manual Operation	Actuator is manually operated and is preventing actuator movement (e.g. actuator is disengaged/decoupled).
11	Protection	Protection is activated.

5.3.6. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	UpOrOpen	client ⇒ server	Y	O	M
0x01	DownOrClose	client ⇒ server	Y	O	M
0x02	StopMotion	client ⇒ server	Y	O	M
0x04	GoToLiftValue	client ⇒ server	Y	O	[LF & ABS]
0x05	GoToLiftPercentage	client ⇒ server	Y	O	LF & PA_LF, [LF]

ID	Name	Direction	Response	Access	Conformance
0x07	GoToTiltValue	client ⇒ server	Y	O	[TL & ABS]
0x08	GoToTiltPercentage	client ⇒ server	Y	O	TL & PA_TL, [TL]

5.3.6.1. UpOrOpen Command

Upon receipt of this command, the Window Covering will adjust its position so the physical lift/slide and tilt is at the maximum open/up position. This will happen as fast as possible. The server attributes SHALL be updated as follows:

if *Position Aware* feature is supported:

- TargetPositionLiftPercent100ths attribute SHALL be set to 0.00%.
- TargetPositionTiltPercent100ths attribute SHALL be set to 0.00%.

The server positioning attributes will follow the movements, once the movement has successfully finished, the server attributes SHALL be updated as follows:

if *Position Aware* feature is supported:

- CurrentPositionLiftPercent100ths attribute SHALL be 0.00%.
- CurrentPositionLiftPercentage attribute SHALL be 0%.
- CurrentPositionTiltPercent100ths attribute SHALL be 0.00%.
- CurrentPositionTiltPercentage attribute SHALL be 0%.

if *Absolute Position* feature is supported:

- CurrentPositionLift attribute SHALL be equal to the InstalledOpenLimitLift attribute.
- CurrentPositionTilt attribute SHALL be equal to the InstalledOpenLimitTilt attribute.

5.3.6.2. DownOrClose Command

Upon receipt of this command, the Window Covering will adjust its position so the physical lift/slide and tilt is at the maximum closed/down position. This will happen as fast as possible. The server attributes supported SHALL be updated as follows:

if *Position Aware* feature is supported:

- TargetPositionLiftPercent100ths attribute SHALL be set to 100.00%.
- TargetPositionTiltPercent100ths attribute SHALL be set to 100.00%.

The server positioning attributes will follow the movements, once the movement has successfully finished, the server attributes SHALL be updated as follows:

if *Position Aware* feature is supported:

- CurrentPositionLiftPercent100ths attribute SHALL be 100.00%.

- CurrentPositionLiftPercentage attribute SHALL be 100%.
- CurrentPositionTiltPercent100ths attribute SHALL be 100.00%.
- CurrentPositionTiltPercentage attribute SHALL be 100%.

if *Absolute Position* feature is supported:

- CurrentPositionLift attribute SHALL be equal to the InstalledClosedLimitLift attribute.
- CurrentPositionTilt attribute SHALL be equal to the InstalledClosedLimitTilt attribute.

5.3.6.3. StopMotion Command

Upon receipt of this command, the Window Covering will stop any adjusting to the physical tilt and lift/slides that is currently occurring. The server attributes supported SHALL be updated as follows:

- TargetPositionLiftPercent100ths attribute will be set to CurrentPositionLiftPercent100ths attribute value.
- TargetPositionTiltPercent100ths attribute will be set to CurrentPositionTiltPercent100ths attribute value.

5.3.6.4. GoToLiftValue Command

The GoToLiftValue command SHALL have the following data fields:

ID	Name	Unit	Type	Constraint	Quality	Default	Conformance
0	LiftValue	cm	uint16	desc			M

Upon receipt of this command, the Window Covering will adjust the window so the physical lift/slides is at the value specified in the payload of this command as long as that value is not larger than InstalledOpenLimitLift attribute and not smaller than InstalledClosedLimitLift attribute. Once the command is received the TargetPositionLiftPercent100ths attribute will update its value accordingly. If the value is out of bounds a response containing the status of CONSTRAINT_ERROR will be returned.

5.3.6.5. GoToLiftPercentage Command

The GoToLiftPercentage command SHALL have the following data fields:

ID	Name	Unit	Type	Constraint	Quality	Default	Conformance
0	LiftPer-cent-ageValue	1%	percent	desc			O.a
1	LiftPer-cent100ths Value	0.01%	per-cent100ths	desc			O.a

Upon receipt of this command, the server will adjust the window covering to the lift/slide percentage specified in the payload of this command.

If the command includes LiftPercent100thsValue, then TargetPositionLiftPercent100ths attribute SHALL be set to LiftPercent100thsValue. Otherwise the TargetPositionLiftPercent100ths attribute SHALL be set to LiftPercentageValue * 100.

If a client includes LiftPercent100thsValue in the command, the LiftPercentageValue SHALL be set to LiftPercent100thsValue / 100, so a legacy server which only supports LiftPercentageValue (not LiftPercent100thsValue) has a value to set the target position.

If the server does not support the Position Aware feature, then a zero percentage SHALL be treated as a UpOrOpen command and a non-zero percentage SHALL be treated as an DownOrClose command. If the device is only a tilt control device, then the command SHOULD be ignored and a UNSUPPORTED_COMMAND status SHOULD be returned.

5.3.6.6. GoToTiltValue Command

The GoToTiltValue command SHALL have the following data fields:

ID	Name	Unit	Type	Constraint	Quality	Default	Conformance
0	TiltValue	0.1°	uint16	desc			M

Upon receipt of this command, the Window Covering will adjust the window so the physical tilt is at the tilt value specified in the payload of this command as long as that value is not larger than InstalledOpenLimitTilt attribute and not smaller than InstalledClosedLimitTilt attribute. Once the command is received the TargetPositionTiltPercent100ths attribute will update its value accordingly. If the tilt value is out of bounds a response containing the status of CONSTRAINT_ERROR will be returned.

5.3.6.7. GoToTiltPercentage Command

The GoToTiltPercentage command SHALL have the following data fields:

ID	Name	Unit	Type	Constraint	Quality	Default	Conformance
0	TiltPercent- ageValue	1%	percent	desc			O.a
1	TiltPercent100ths Value	0.01%	per- cent100ths	desc			O.a

Upon receipt of this command, the server will adjust the window covering to the tilt percentage specified in the payload of this command.

If the command includes TiltPercent100thsValue, then TargetPositionTiltPercent100ths attribute

SHALL be set to TiltPercent100thsValue. Otherwise the TargetPositionTiltPercent100ths attribute SHALL be set to TiltPercentageValue * 100.

If a client includes TiltPercent100thsValue in the command, the TiltPercentageValue SHALL be set to TiltPercent100thsValue / 100, so a legacy server which only supports TiltPercentageValue (not TiltPercent100thsValue) has a value to set the target position.

If the server does not support the Position Aware feature, then a zero percentage SHALL be treated as a UpOrOpen command and a non-zero percentage SHALL be treated as an DownOrClose command. If the device is only a tilt control device, then the command SHOULD be ignored and a UNSUPPORTED_COMMAND status SHOULD be returned.

5.3.6.8. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following extension fields SHALL be added to the Scene Table in the given order:

- CurrentPositionLiftPercentage
- CurrentPositionTiltPercentage
- TargetPositionLiftPercent100ths
- TargetPositionTiltPercent100ths

When a Percentage attribute is part of a Scene Table, the attribute is treated as a writeable command, that is, activate a motion (Lift or Tilt) on the window covering device to the percentage specified in the Scene Table over the specified transition time.

The device MAY treat the commands as linear transitions if appropriate or MAY accelerate and decelerate as it deems necessary.

For position aware devices, a percentage written by a scene to either the Current or Target Lift/Tilt attributes MUST be treated as a GoToLiftPercentage/GoToTiltPercentage command. Using the CurrentPosition Attribute results in writing the received percentage to the associated TargetPosition and activate the motion (Lift or Tilt) of the window covering device to the specified percentage.

For position unaware devices, a percentage of 0 is treated as a UpOrOpen command and a non-zero percentage is treated as an DownOrClose command and the device will ignore the transition time and transition as fast as appropriate for that device.

Attributes in the Scene Table that are not supported by the device (according to the FeatureMap attribute) SHALL be present in the scene table but ignored.

5.3.7. Status Codes

This cluster uses the standard Default Response command defined for responding to received commands. Expected status response is SUCCESS. No cluster specific status codes are defined.

Chapter 6. Media

The Cluster Library is made of individual chapters such as this one. See Document Control in the Cluster Library for a list of all chapters and documents. References between chapters are made using a $X.Y$ notation where X is the chapter and Y is the sub-section within that chapter. References to external documents are contained in Chapter 1 and are made using $[Rn]$ notation.

6.1. General Description

6.1.1. Introduction

The clusters specified in this document are for use typically in applications involving media (e.g., Video Players, Content Apps, Speakers), but MAY be used in any application domain.

6.1.2. Cluster List

This section lists the clusters specified in this document, and gives examples of typical usage for the purpose of clarification.

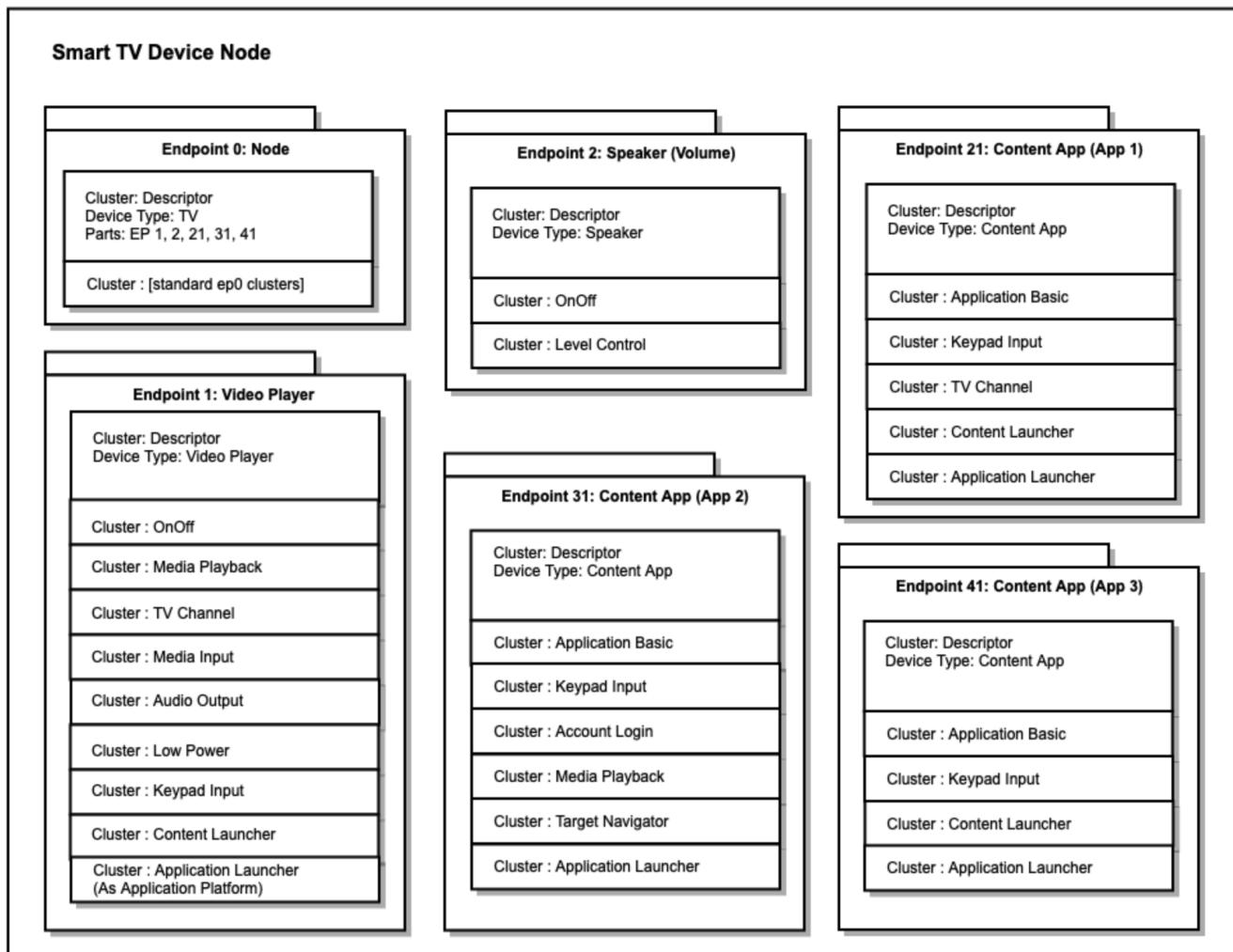
The clusters defined in this document are listed in [Table 96, “Media Clusters”](#).

Table 96. Media Clusters

ID	Cluster Name	Description
0x050e	Account Login	This cluster provides an interface for facilitating user account login on an application or a node.
0x050d	Application Basic	Provides information about a Content App running on a Video Player device which is represented as an endpoint.
0x050c	Application Launcher	This cluster provides an interface for launching content on a Video Player device.
0x050b	Audio Output	This cluster provides an interface for controlling the Output on a Video Player device.
0x0504	Channel	This cluster provides an interface for controlling the current Channel on an endpoint.
0x050a	Content Launcher	This cluster provides an interface for launching content on a Video Player device or a Content App.

ID	Cluster Name	Description
0x0509	Keypad Input	This cluster provides an interface for controlling a Video Player or a Content App using action commands such as UP, DOWN, and SELECT.
0x0507	Media Input	This cluster provides an interface for controlling the Input Selector on a Video Player device.
0x0506	Media Playback	This cluster provides an interface for controlling Media Playback (PLAY, PAUSE, etc) on a Video Player device.
0x0505	Target Navigator	This cluster provides an interface for UX navigation within a set of targets on a Video Player device or Content App endpoint.

Example Usage of the Media Clusters



6.2. Account Login Cluster

This cluster provides commands that facilitate user account login on a Content App or a node. For example, a Content App running on a Video Player device, which is represented as an endpoint (see Device Type Library document), can use this cluster to help make the user account on the Content App match the user account on the Client.

6.2.1. Overview

The cluster server for this cluster may be supported on each endpoint that represents a Content App on a Video Player device.

See Device Type Library document for details of how a Content App, represented as an endpoint on the Video Player device, may implement the cluster server for this cluster to simplify account login for its users.

6.2.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.2.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	ALOGIN

6.2.1.3. Cluster Identifiers

Identifier	Name
0x050e	Account Login

6.2.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description

6.2.3. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance

6.2.4. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	GetSetupPIN	Client ⇒ Server	GetSetupPIN-Response	T A	M
0x01	GetSetupPIN-Response	Server ⇒ Client	N		M
0x02	Login	Client ⇒ Server	Y	T A	M
0x03	Logout	Client ⇒ Server	Y	T O	M

6.2.4.1. GetSetupPIN Command

The purpose of this command is to determine if the active user account of the given Content App matches the active user account of a given Commissionee, and when it does, return a Setup PIN code which can be used for password-authenticated session establishment (PASE) with the Commissionee.

For example, a Video Player with a Content App Platform may invoke this command on one of its Content App endpoints to facilitate commissioning of a Phone App made by the same vendor as the Content App. If the accounts match, then the Content App may return a setup code that can be used by the Video Player to commission the Phone App without requiring the user to physically input a setup code.

The account match is determined by the Content App using a method which is outside the scope of this specification and will typically involve a central service which is in communication with both the Content App and the Commissionee. The GetSetupPIN command is needed in order to provide the Commissioner/Admin with a Setup PIN when this Commissioner/Admin is operated by a different vendor from the Content App.

This method is used to facilitate Setup PIN exchange (for PASE) between Commissioner and Commissionee when the same user account is active on both nodes. With this method, the Content App satisfies proof of possession related to commissioning by requiring the same user account to be active on both Commissionee and Content App, while the Commissioner/Admin ensures user consent by prompting the user prior to invocation of the command.

Upon receipt of this command, the Content App checks if the account associated with the Temporary Account Identifier sent by the client is the same account that is active on itself. If the accounts are the same, then the Content App returns the GetSetupPIN Response which includes a Setup PIN that may be used for PASE with the Commissionee.

The Temporary Account Identifier for a Commissionee may be populated with the Rotating ID field of the client's commissionable node advertisement (see Rotating Device Identifier section in [\[MatterCore\]](#)) encoded as an octet string where the octets of the Rotating Device Identifier are encoded as 2-character sequences by representing each octet's value as a 2-digit hexadecimal number, using uppercase letters.

The Setup PIN is an 11 character string so that it can accommodate different future formats, including alpha-numeric encodings. For a Commissionee it SHALL be populated with the Manual Pairing

Code (see Manual Pairing Code section in [MatterCore]) encoded as a string.

The Server SHALL implement rate limiting to prevent brute force attacks. No more than 10 unique requests in a 10 minute period SHALL be allowed; a command response status of FAILURE should be sent for additional commands received within the 10 minute period. Because access to this command is limited to nodes with Admin-level access, and the user is prompted for consent prior to Commissioning, there are in place multiple obstacles to successfully mounting a brute force attack. A Content App that supports this command SHALL ensure that the Temporary Account Identifier used by its clients is not valid for more than 10 minutes.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	TempAccountIdentifier	string	min 16 max 100			M

6.2.4.1.1. TempAccountIdentifier

This attribute SHALL specify the client's Temporary Account Identifier. The length of this field SHALL be at least 16 characters to protect the account holder against password guessing attacks.

6.2.4.2. GetSetupPINResponse Command

This message is sent in response to the GetSetupPIN command, and contains the Setup PIN code, or null when the account identified in the request does not match the active account of the running Content App.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	SetupPIN	string	min 11	X		M

6.2.4.2.1. SetupPIN

This field SHALL provide the setup PIN code as a text string at least 11 characters in length or null to indicate that the accounts do not match.

6.2.4.3. Login Command

The purpose of this command is to allow the Content App to assume the user account of a given Commissionee by leveraging the Setup PIN code input by the user during the commissioning process.

For example, a Video Player with a Content App Platform may invoke this command on one of its Content App endpoints after the commissioning has completed of a Phone App made by the same vendor as the Content App. The Content App may determine whether the Temporary Account Identifier maps to an account with a corresponding Setup PIN and, if so, it may automatically login to the account for the corresponding user. The end result is that a user performs commissioning of a Phone App to a Video Player by inputting the Setup PIN for the Phone App into the Video Player UX. Once commissioning has completed, the Video Player invokes this command to allow the corre-

sponding Content App to assume the same user account as the Phone App.

The verification of Setup PIN for the given Temporary Account Identifier is determined by the Content App using a method which is outside the scope of this specification and will typically involve a central service which is in communication with both the Content App and the Commissionee. Implementations of such a service should impose aggressive time outs for any mapping of Temporary Account Identifier to Setup PIN in order to prevent accidental login due to delayed invocation.

Upon receipt, the Content App checks if the account associated with the client's Temp Account Identifier has a current active Setup PIN with the given value. If the Setup PIN is valid for the user account associated with the Temp Account Identifier, then the Content App MAY make that user account active.

The Temporary Account Identifier for a Commissionee may be populated with the Rotating ID field of the client's commissionable node advertisement encoded as an octet string where the octets of the Rotating Device Identifier are encoded as 2-character sequences by representing each octet's value as a 2-digit hexadecimal number, using uppercase letters.

The Setup PIN for a Commissionee may be populated with the Manual Pairing Code encoded as a string of decimal numbers.

The Server SHALL implement rate limiting to prevent brute force attacks. No more than 10 unique requests in a 10 minute period SHALL be allowed; a command response status of FAILURE should be sent for additional commands received within the 10 minute period. Because access to this command is limited to nodes with Admin-level access, and the user is involved when obtaining the SetupPIN, there are in place multiple obstacles to successfully mounting a brute force attack. A Content App that supports this command SHALL ensure that the Temporary Account Identifier used by its clients is not valid for more than 10 minutes.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	TempAccountIdentifier	string	min 16 max 100			M
1	SetupPIN	string	min 11			M

6.2.4.3.1. TempAccountIdentifier

This field SHALL specify the client's temporary account identifier.

6.2.4.3.2. SetupPIN

This field SHALL provide the setup PIN code as a text string at least 11 characters in length.

6.2.4.4. Logout Command

The purpose of this command is to instruct the Content App to clear the current user account. This command SHOULD be used by clients of a Content App to indicate the end of a user session.

6.3. Application Basic Cluster

This cluster provides information about a Content App running on a Video Player device which is represented as an endpoint (see Device Type Library document).

6.3.1. Overview

The cluster server for this cluster should be supported on each endpoint that represents a Content App on a Video Player device. This cluster provides identification information about the Content App such as vendor and product.

6.3.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.3.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	APBSC

6.3.1.3. Cluster Identifiers

Identifier	Name
0x050d	Application Basic

6.3.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description

6.3.3. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Vendor-Name	string	max 32	F	empty	R V	O
0x0001	VendorID	vendor-id	all	F		R V	O
0x0002	ApplicationName	string	desc	F		R V	M
0x0003	ProductID	uint16	all	F		R V	O

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0004	Application	ApplicationStruct	desc	F		R V	M
0x0005	Status	ApplicationStatusEnum	desc		ms	R V	M
0x0006	ApplicationVersion	string	max 32	F		R V	M
0x0007	Allowed-VendorList	list[vendor-id]	none	F		R A	M

6.3.3.1. VendorName Attribute

This attribute SHALL specify a human readable (displayable) name of the vendor for the Content App.

6.3.3.2. VendorID Attribute

This attribute, if present, SHALL specify the Connectivity Standards Alliance assigned Vendor ID for the Content App.

6.3.3.3. ApplicationName Attribute

This attribute SHALL specify a human readable (displayable) name of the Content App assigned by the vendor. For example, "NPR On Demand". The maximum length of the ApplicationName attribute is 256 bytes of UTF-8 characters.

6.3.3.4. ProductID Attribute

This attribute, if present, SHALL specify a numeric ID assigned by the vendor to identify a specific Content App made by them. If the Content App is certified by the Connectivity Standards Alliance, then this would be the Product ID as specified by the vendor for the certification.

6.3.3.5. Application Attribute

This attribute SHALL specify a Content App which consists of an Application ID using a specified catalog.

6.3.3.6. Status Attribute

This attribute SHALL specify the current running status of the application.

6.3.3.7. ApplicationVersion Attribute

This attribute SHALL specify a human readable (displayable) version of the Content App assigned by the vendor. The maximum length of the ApplicationVersion attribute is 32 bytes of UTF-8 charac-

ters.

6.3.3.8. AllowedVendorList Attribute

This is a list of vendor IDs. Each entry is a vendor-id.

6.3.4. Data Types

6.3.4.1. ApplicationStruct

This indicates a global identifier for an Application given a catalog.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	CatalogVendorID	uint16	all			M
1	ApplicationID	string	all			M

6.3.4.1.1. CatalogVendorID

This SHALL indicate the Connectivity Standards Alliance issued vendor ID for the catalog. The DIAL registry SHALL use value 0x0000.

It is assumed that Content App Platform providers (see Video Player Architecture section in [\[Matter-DevLib\]](#)) will have their own catalog vendor ID (set to their own Vendor ID) and will assign an ApplicationID to each Content App.

6.3.4.1.2. ApplicationID

This SHALL indicate the application identifier, expressed as a string, such as "123456-5433", "PruneVideo" or "Company X". This field SHALL be unique within a catalog.

For the DIAL registry catalog, this value SHALL be the DIAL prefix.

6.3.4.2. ApplicationStatusEnum

ApplicationStatusEnum Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Stopped	M	Application is not running.
1	ActiveVisibleFocus	M	Application is running, is visible to the user, and is the active target for input.

Value	Name	Conformance	Description
2	ActiveHidden	M	Application is running but not visible to the user.
3	ActiveVisibleNotFocus	M	Application is running and visible, but is not the active target for input.

6.4. Application Launcher Cluster

This cluster provides an interface for launching applications on a Video Player device such as a TV.

6.4.1. Overview

This cluster is supported on endpoints that can launch Applications, such as a Casting Video Player device with a Content App Platform. It supports identifying an Application by global identifier from a given catalog, and launching it. It also supports tracking the currently in-focus Application.

Depending on the support for the [Application Platform](#) feature, the cluster can either support launching the application corresponding to the endpoint on which the cluster is supported ([AP](#) feature not supported) or it can support launching any application ([AP](#) feature supported).

6.4.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.4.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	APPLAUNCHER

6.4.1.3. Cluster Identifiers

Identifier	Name
0x050c	Application Launcher

6.4.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description
0	AP	Application Platform	Support for attributes and commands required for endpoint to support launching any application within the supported application catalogs

6.4.3. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	CatalogList	list[uint16]	none	N		R V	AP
0x0001	CurrentApp	ApplicationEP-Struct	desc	X	null	R V	O

6.4.3.1. CatalogList Attribute

This attribute SHALL specify the list of supported application catalogs, where each entry in the list is the CSA-issued vendor ID for the catalog. The DIAL registry (see [DIAL Registry]) SHALL use value 0x0000.

It is expected that Content App Platform providers will have their own catalog vendor ID (set to their own Vendor ID) and will assign an ApplicationID to each Content App.

6.4.3.2. CurrentApp Attribute

This attribute SHALL specify the current in-focus application, identified using an Application ID, catalog vendor ID and the corresponding endpoint number when the application is represented by a Content App endpoint. A null SHALL be used to indicate there is no current in-focus application.

6.4.4. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	LaunchApp	Client ⇒ Server	LauncherRe- sponse	O	M
0x01	StopApp	Client ⇒ Server	LauncherRe- sponse	O	M
0x02	HideApp	Client ⇒ Server	LauncherRe- sponse	O	M

ID	Name	Direction	Response	Access	Conformance
0x03	LauncherResponse	Server ⇒ Client	N		M

6.4.4.1. LaunchApp Command

Upon receipt of this command, the server SHALL launch the application with optional data. The application SHALL be either

- the specified application, if the Application Platform feature is supported;
- otherwise the application corresponding to the endpoint.

The endpoint SHALL launch and bring to foreground the requisite application if the application is not already launched and in foreground. The **Status** attribute SHALL be updated to **ACTIVE_VISIBLE_FOCUS** on the Application Basic cluster of the Endpoint corresponding to the launched application. The **Status** attribute SHALL be updated on any other application whose **Status** MAY have changed as a result of this command. The **CurrentApp** attribute, if supported, SHALL be updated to reflect the new application in the foreground.

This command returns a Launcher Response.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Application	Application-Struct	desc			AP
1	Data	octstr	any		ms	O

6.4.4.1.1. Application

This field SHALL specify the **Application** to launch.

6.4.4.1.2. Data

This field SHALL specify optional app-specific data to be sent to the app.

Note: This format and meaning of this value is proprietary and outside the specification. It provides a transition path for device makers that use other protocols (like DIAL) which allow for proprietary data. Apps that are not yet Matter aware can be launched via Matter, while retaining the existing ability to launch with proprietary data.

6.4.4.2. StopApp Command

Upon receipt of this command, the server SHALL stop the application if it is running. The application SHALL be either

- the specified application, if the Application Platform feature is supported;
- otherwise the application corresponding to the endpoint.

The **Status** attribute SHALL be updated to **STOPPED** on the Application Basic cluster of the Endpoint corresponding to the stopped application. The **Status** attribute SHALL be updated on any other application whose **Status** MAY have changed as a result of this command.

This command returns a Launcher Response.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Application	Application-Struct	desc		ms	AP

6.4.4.2.1. Application

This field SHALL specify the **Application** to stop.

6.4.4.3. HideApp Command

Upon receipt of this command, the server SHALL hide the application. The application SHALL be either

- the specified application, if the Application Platform feature is supported;
- otherwise the application corresponding to the endpoint.

The endpoint MAY decide to stop the application based on manufacturer specific behavior or resource constraints if any. The **Status** attribute SHALL be updated to **ACTIVE_HIDDEN** or **STOPPED**, depending on the action taken, on the Application Basic cluster of the Endpoint corresponding to the application on which the action was taken. The **Status** attribute SHALL be updated on any other application whose **Status** MAY have changed as a result of this command.

This command returns a Launcher Response.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Application	Application-Struct	desc		ms	AP

6.4.4.3.1. Application

This field SHALL specify the **Application** to hide.

6.4.4.4. LauncherResponse Command

This command SHALL be generated in response to LaunchApp/StopApp/HideApp commands.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Status	StatusEnum	all			M
1	Data	octstr	any		ms	O

6.4.4.4.1. Status

This SHALL indicate the status of the command which resulted in this response.

6.4.4.4.2. Data

This SHALL specify Optional app-specific data.

6.4.5. Data Types

6.4.5.1. StatusEnum

StatusEnum Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Success	M	Command succeeded
1	AppNotAvailable	M	Requested app is not available.
2	SystemBusy	M	Video platform unable to honor command.

6.4.5.2. ApplicationStruct

This indicates a global identifier for an Application given a catalog.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	CatalogVendorID	uint16	all			M
1	ApplicationID	string	all			M

6.4.5.2.1. CatalogVendorID

This SHALL indicate the CSA-issued vendor ID for the catalog. The DIAL registry SHALL use value 0x0000.

Content App Platform providers will have their own catalog vendor ID (set to their own Vendor ID) and will assign an ApplicationID to each Content App.

6.4.5.2.2. ApplicationID

This SHALL indicate the application identifier, expressed as a string, such as "PruneVideo" or "Company X". This field SHALL be unique within a catalog.

For the DIAL registry catalog, this value SHALL be the DIAL prefix (see [[DIAL Registry](#)]).

6.4.5.3. ApplicationEPStruct

This specifies an app along with its corresponding endpoint.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Application	Application-Struct	all			M
1	Endpoint	endpoint-no	all		ms	O

6.5. Audio Output Cluster

This cluster provides an interface for controlling the Output on a Video Player device such as a TV.

6.5.1. Overview

This cluster would be supported on a device with audio outputs like a Video Player device (Smart TV, TV Setup Top Box, Smart Speaker, etc).

This cluster provides the list of available outputs and provides commands for selecting and renaming them.

The cluster server for Audio Output is implemented by a device that has configurable audio output.

6.5.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.5.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	AUDIOOUTPUT

6.5.1.3. Cluster Identifiers

Identifier	Name
0x050b	Audio Output

6.5.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description
0	NU	Name Updates	Supports updates to output names

6.5.3. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	OutputList	list[OutputInfoStruct]	none			R V	M
0x0001	CurrentOutput	uint8	all			R V	M

6.5.3.1. OutputList Attribute

This list provides the outputs supported by the device.

6.5.3.2. CurrentOutput Attribute

This field contains the value of the index field of the currently selected *OutputInfoStruct*.

6.5.4. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	SelectOutput	Client ⇒ Server	Y	O	M
0x01	RenameOutput	Client ⇒ Server	Y	M	NU

6.5.4.1. SelectAudioOutput Command

Upon receipt, this SHALL change the output on the device to the output at a specific index in the Output List.

Note that when the current output is set to an output of type HDMI, adjustments to volume via a Speaker endpoint on the same node MAY cause HDMI volume up/down commands to be sent to the given HDMI output.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Index	uint8	all			M

6.5.4.1.1. Index

This SHALL indicate the index field of the *OutputInfoStruct* from the OutputList attribute in which to change to.

6.5.4.2. RenameOutput Command

Upon receipt, this SHALL rename the output at a specific index in the Output List.

Updates to the output name SHALL appear in the device's settings menus. Name updates MAY automatically be sent to the actual device to which the output connects.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Index	uint8	all			M
1	Name	string	all			M

6.5.5. Data Types

6.5.5.1. OutputInfoStruct

This contains information about an output.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Index	uint8	all			M
1	OutputType	OutputTypeEnum	desc			M
2	Name	string	all			M

6.5.5.1.1. Index

This SHALL indicate the unique index into the list of outputs.

6.5.5.1.2. OutputType

This SHALL indicate the type of output

6.5.5.1.3. Name

The device defined and user editable output name, such as "Soundbar", "Speakers". This field may be blank, but SHOULD be provided when known.

6.5.5.2. OutputTypeEnum

OutputTypeEnum

OutputType Data Type is derived from enum8.

The type of output, expressed as an enum, with the following values:

Value	Name	Conformance	Description
0	HDMI	M	HDMI

Value	Name	Conformance	Description
1	BT	M	
2	Optical	M	
3	Headphone	M	
4	Internal	M	
5	Other	M	

6.6. Channel Cluster

This cluster provides an interface for controlling the current Channel on a device or endpoint.

6.6.1. Overview

This cluster server would be supported on Video Player devices or endpoints that allow Channel control such as a Content App. This cluster provides a list of available channels and provides commands for absolute and relative channel changes.

The cluster server for Channel is implemented by an endpoint that controls the current Channel.

6.6.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.6.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	CHANNEL

6.6.1.3. Cluster Identifiers

Identifier	Name
0x0504	Channel

6.6.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description
0	CL	Channel List	Provides list of available channels.

Bit	Code	Feature	Description
1	LI	Lineup Info	Provides lineup info, which is a reference to an external source of lineup information.

6.6.3. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Channel-List	list[ChannelInfoStruct]	none		empty	R V	CL
0x0001	Lineup	LineupInfoStruct	desc			R V	LI
0x0002	CurrentChannel	ChannelInfoStruct	desc	X	null	R V	O

6.6.3.1. ChannelList Attribute

This optional list provides the channels supported.

6.6.3.2. Lineup Attribute

This optional field identifies the channel lineup using external data sources.

6.6.3.3. CurrentChannel Attribute

This optional field contains the current channel. When supported but a channel is not currently tuned to (if a content application is in foreground), the value of the field SHALL be null.

6.6.4. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	ChangeChannel	Client ⇒ Server	ChangeChannelResponse	O	CL or LI
0x01	ChangeChannelResponse	Server ⇒ Client	N		CL or LI
0x02	ChangeChannelByNumber	Client ⇒ Server	Y	O	M
0x03	SkipChannel	Client ⇒ Server	Y	O	M

6.6.4.1. ChangeChannel Command

Change the channel to the channel case-insensitive exact matching the value passed as an argument.

The match priority order SHALL be: AffiliateCallSign ("KCTS"), CallSign ("PBS"), Name ("Comedy Central"), Number ("13.1")

Upon receipt, this SHALL generate a ChangeChannelResponse command.

Upon success, the CurrentChannel attribute, if supported, SHALL be updated to reflect the change.

The data for this command SHALL be as follows:

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Match	string				M

6.6.4.1.1. Match

This SHALL contain a user-input string to match in order to identify the target channel.

6.6.4.2. ChangeChannelResponse Command

This command SHALL be generated in response to a ChangeChannel command. The data for this command SHALL be as follows:

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Status	StatusEnum	desc			M
1	Data	octstr	any			O

6.6.4.2.1. Status

This SHALL indicate the status of the command which resulted in this response.

6.6.4.2.2. Data

This SHALL indicate Optional app-specific data.

6.6.4.3. ChangeChannelByNumber Command

Change the channel to the channel with the given Number in the *ChannelList* attribute.

The data for this command SHALL be as follows:

ID	Field	Type	Constraint	Quality	Default	Conformance
0	MajorNumber	uint16	all			M
1	MinorNumber	uint16	all			M

6.6.4.3.1. MajorNumber

This SHALL indicate the channel major number value (ATSC format) to which the channel should change.

6.6.4.3.2. MinorNumber

This SHALL indicate the channel minor number value (ATSC format) to which the channel should change.

6.6.4.4. SkipChannel Command

This command provides channel up and channel down functionality, but allows channel index jumps of size *Count*.

When the value of the increase or decrease is larger than the number of channels remaining in the given direction, then the behavior SHALL be to return to the beginning (or end) of the channel list and continue. For example, if the current channel is at index 0 and count value of -1 is given, then the current channel should change to the last channel.

The data for this command is as follows:

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Count	int16	all			M

6.6.4.4.1. Count

This SHALL indicate the number of steps to increase (Count is positive) or decrease (Count is negative) the current channel.

6.6.5. Data Types

6.6.5.1. ChannelInfoStruct

This indicates a channel in a channel lineup.

While the major and minor numbers in the ChannelInfoStruct support use of ATSC channel format, a lineup MAY use other formats which can map into these numeric values.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	MajorNumber	uint16	all			M
1	MinorNumber	uint16	all			M
2	Name	string			empty	O
3	CallSign	string			empty	O
4	AffiliateCallSign	string			empty	O

6.6.5.1.1. MajorNumber

This SHALL indicate the channel major number value (for example, using ATSC format). When the channel number is expressed as a string, such as "13.1" or "256", the major number would be 13 or 256, respectively.

6.6.5.1.2. MinorNumber

This SHALL indicate the channel minor number value (for example, using ATSC format). When the channel number is expressed as a string, such as "13.1" or "256", the minor number would be 1 or 0, respectively.

6.6.5.1.3. Name

This SHALL indicate the marketing name for the channel, such as "The CW" or "Comedy Central". This field is optional, but SHOULD be provided when known.

6.6.5.1.4. CallSign

This SHALL indicate the call sign of the channel, such as "PBS". This field is optional, but SHOULD be provided when known.

6.6.5.1.5. AffiliateCallSign

This SHALL indicate the local affiliate call sign, such as "KCTS". This field is optional, but SHOULD be provided when known.

6.6.5.2. LineupInfoStruct

The Lineup Info allows references to external lineup sources like Gracenote. The combination of OperatorName, LineupName, and PostalCode MUST uniquely identify a lineup.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Operator-Name	string				M

ID	Name	Type	Constraint	Quality	Default	Conformance
1	LineupName	string			empty	O
2	PostalCode	string			empty	O
3	LineupInfo-Type	LineupInfo-TypeEnum	desc			M

6.6.5.2.1. OperatorName

This SHALL indicate the name of the operator, for example "Comcast".

6.6.5.2.2. Lineup Name

This SHALL indicate the name of the provider lineup, for example "Comcast King County". This field is optional, but SHOULD be provided when known.

6.6.5.2.3. Postal Code

This SHALL indicate the postal code (zip code) for the location of the device, such as "98052". This field is optional, but SHOULD be provided when known.

6.6.5.2.4. LineupInfoType

This SHALL indicate the type of lineup. This field is optional, but SHOULD be provided when known.

Value	Description
MSO	MultiSystemOperator.

6.6.5.3. LineupInfoTypeEnum

LineupInfoTypeEnum Data Type is derived from enum8.

Value	Name	Conformance	Description
0	MSO	M	MultiSystemOperator

6.6.5.4. StatusEnum

StatusEnum Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Success	M	Command succeeded
1	MultipleMatches	M	More than one equal match for the ChannelInfoStruct passed in.

Value	Name	Conformance	Description
2	NoMatches	M	No matches for the ChannelInfoStruct passed in.

6.7. Content Launcher Cluster

This cluster provides an interface for launching content on a Video Player device such as a Streaming Media Player, Smart TV or Smart Screen.

6.7.1. Overview

This cluster would be supported on a Video Player device or devices that can playback content, such as a Streaming Media Player, Smart TV or Smart Screen. This cluster supports playing back content referenced by URL. It supports finding content by type and global identifier, and either playing the content or displaying the search results.

The cluster server for Content Launcher is implemented by an endpoint that can launch content, such as a Video Player, or an endpoint representing a Content App on such a device.

When this cluster is implemented for an Content App Endpoint (Endpoint with type “Content App” and having an Application Basic cluster), the Video Player device SHALL launch the application when a client invokes the LaunchContent or LaunchURL commands.

6.7.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.7.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	CONTENTLAUNCHER

6.7.1.3. Cluster Identifiers

Identifier	Name
0x050a	Content Launcher

6.7.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description
0	CS	Content Search	Device supports content search (non-app specific)
1	UP	URL Playback	Device supports basic URL-based file playback

6.7.3. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Accept-Header	list[string]	max 100[max 1024]	N	empty	R V	UP
0x0001	Supported-Streaming-Protocols	map32		N	0	R V	UP

6.7.3.1. AcceptHeader Attribute

This list provides list of content types supported by the Video Player or Content App in the form of entries in the HTTP "Accept" request header.

6.7.3.2. SupportedStreamingProtocols Attribute

This attribute provides information about supported streaming protocols.

6.7.3.2.1. Existing Supported Protocols

Bit	Mapped Protocol	Description
0	DASH	Device supports Dynamic Adaptive Streaming over HTTP (DASH)
1	HLS	Device supports HTTP Live Streaming (HLS)

6.7.4. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	LaunchContent	Client ⇒ Server	LauncherResponse	O	CS
0x01	LaunchURL	Client ⇒ Server	LauncherResponse	O	UP

ID	Name	Direction	Response	Access	Conformance
0x02	LauncherResponse	Server ⇒ Client	N		CS UP

6.7.4.1. LaunchContent Command

Upon receipt, this SHALL launch the specified content with optional search criteria.

This command returns a Launch Response.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Search	ContentSearchStruct	desc			M
1	AutoPlay	bool	desc			M
2	Data	octstr			ms	O

6.7.4.1.1. Search

This SHALL indicate the content to launch.

6.7.4.1.2. AutoPlay

This SHALL indicate whether to automatically start playing content, where: * TRUE means best match should start playing automatically. * FALSE means matches should be displayed on screen for user selection.

6.7.4.1.3. Data

This SHALL indicate Optional app-specific data.

6.7.4.2. LaunchURL Command

Upon receipt, this SHALL launch content from the specified URL.

The content types supported include those identified in the AcceptHeader and SupportedStreamingProtocols attributes.

A check SHALL be made to ensure the URL is secure (uses HTTPS).

This command returns a Launch Response.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	ContentURL	string	any			M
1	DisplayString	string	any		ms	O

ID	Field	Type	Constraint	Quality	Default	Conformance
2	BrandingInformation	BrandingInformation-Struct	any		ms	O

6.7.4.2.1. ContentURL

This SHALL indicate the URL of content to launch.

6.7.4.2.2. DisplayString

This field, if present, SHALL provide a string that MAY be used to describe the content being accessed at the given URL.

6.7.4.2.3. BrandingInformation

This field, if present, SHALL indicate the branding information that MAY be displayed when playing back the given content.

6.7.4.3. LauncherResponse Command

This command SHALL be generated in response to LaunchContent and LaunchURL commands.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Status	StatusEnum	all			M
1	Data	octstr			ms	O

WARNING TODO: Data in table above needs a max size

6.7.4.3.1. Status

This SHALL indicate the status of the command which resulted in this response.

6.7.4.3.2. Data

This SHALL indicate Optional app-specific data.

6.7.5. Data Types

6.7.5.1. StatusEnum

StatusEnum Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Success	M	Command succeeded

Value	Name	Conformance	Description
1	URLNotAvailable	M	Requested URL could not be reached by device.
2	AuthFailed	M	Requested URL returned 401 error code.

6.7.5.2. ContentSearchStruct

This object defines inputs to a search for content for display or playback.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	ParameterList	list[ParameterStruct]	all		0	M

6.7.5.2.1. ParameterList

This SHALL indicate the list of parameters comprising the search. If multiple parameters are provided, the search parameters SHALL be joined with 'AND' logic. e.g. action movies with Tom Cruise will be represented as [{Actor: 'Tom Cruise'}, {Type: 'Movie'}, {Genre: 'Action'}]

6.7.5.3. ParameterStruct

This object defines inputs to a search for content for display or playback.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Type	ParameterEnum	all			M
1	Value	string	max 1024			M
2	ExternalIDList	list[AdditionalInfoStruct]	all		empty	O

6.7.5.3.1. Type

This SHALL indicate the entity type.

6.7.5.3.2. Value

This SHALL indicate the entity value, which is a search string, ex. "Manchester by the Sea".

6.7.5.3.3. ExternalIDList

This SHALL indicate the list of additional external content identifiers.

6.7.5.4. ParameterEnum

Parameter Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Actor	M	Actor represents an actor credited in video media content; for example, "Gaby sHoffman"
1	Channel	M	Channel represents the identifying data for a television channel; for example, "PBS"
2	Character	M	A character represented in video media content; for example, "Snow White"
3	Director	M	A director of the video media content; for example, "Spike Lee"
4	Event	M	An event is a reference to a type of event; examples would include sports, music, or other types of events. For example, searching for "Football games" would search for a 'game' event entity and a 'football' sport entity.

Value	Name	Conformance	Description
5	Franchise	M	A franchise is a video entity which can represent a number of video entities, like movies or TV shows. For example, take the fictional franchise "Intergalactic Wars" which represents a collection of movie trilogies, as well as animated and live action TV shows. This entity type was introduced to account for requests by customers such as "Find Intergalactic Wars movies", which would search for all 'Intergalactic Wars' programs of the MOVIE Media Type, rather than attempting to match to a single title.
6	Genre	M	Genre represents the genre of video media content such as action, drama or comedy.
7	League	M	League represents the categorical information for a sporting league; for example, "NCAA"
8	Popularity	M	Popularity indicates whether the user asks for popular content.
9	Provider	M	The provider (MSP) the user wants this media to be played on; for example, "Netflix".
10	Sport	M	Sport represents the categorical information of a sport; for example, football

Value	Name	Conformance	Description
11	SportsTeam	M	SportsTeam represents the categorical information of a professional sports team; for example, "University of Washington Huskies"
12	Type	M	The type of content requested. Supported types are "Movie", "MovieSeries", "TVSeries", "TVSeason", "TVEpisode", "SportsEvent", and "Video"
13	Video	M	Video represents the identifying data for a specific piece of video content; for example, "Manchester by the Sea".

6.7.5.5. AdditionalInfoStruct

This object defines additional name=value pairs that can be used for identifying content.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Name	string	max 256			M
1	Value	string	max 8192			M

6.7.5.5.1. Name

This SHALL indicate the name of external id, ex. "musicbrainz".

6.7.5.5.2. Value

This SHALL indicate the value for external id, ex. "ST0000000666661".

6.7.5.6. BrandingInformationStruct

This object defines Branding Information which can be provided by the client in order to customize the skin of the Video Player during playback.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Provider-Name	string	max 256			M
1	Background	StyleInformationStruct			ms	O
2	Logo	StyleInformationStruct			ms	O
3	ProgressBar	StyleInformationStruct			ms	O
4	Splash	StyleInformationStruct			ms	O
5	WaterMark	StyleInformationStruct			ms	O

6.7.5.6.1. ProviderName

This SHALL indicate name of the provider for the given content.

6.7.5.6.2. Background

This SHALL indicate background of the Video Player while content launch request is being processed by it. This background information MAY also be used by the Video Player when it is in idle state.

6.7.5.6.3. Logo

This SHALL indicate the logo shown when the Video Player is launching. This is also used when the Video Player is in the idle state and **Splash** field is not available.

6.7.5.6.4. ProgressBar

This SHALL indicate the style of progress bar for media playback.

6.7.5.6.5. Splash

This SHALL indicate the screen shown when the Video Player is in an idle state. If this property is not populated, the Video Player SHALL default to logo or the provider name.

6.7.5.6.6. Watermark

This SHALL indicate watermark shown when the media is playing.

6.7.5.7. StyleInformationStruct

This object defines style information which can be used by content providers to change the Media Player's style related properties.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	ImageURL	string	max 8192		ms	O
1	Color	string	7,9		ms	O
2	Size	Dimension-Struct			ms	O

6.7.5.7.1. ImageURL

This SHALL indicate the URL of image used for Styling different Video Player sections like Logo, Watermark etc.

6.7.5.7.2. Color

This SHALL indicate the color, in RGB or RGBA, used for styling different Video Player sections like Logo, Watermark, etc. The value SHALL conform to the 6-digit or 8-digit format defined for [CSS sRGB hexdecimal color notation](https://www.w3.org/TR/css-color-4/#hex-notation) [<https://www.w3.org/TR/css-color-4/#hex-notation>]. Examples:

- #76DE19 for R=0x76, G=0xDE, B=0x19, A absent
- #76DE1980 for R=0x76, G=0xDE, B=0x19, A=0x80

6.7.5.7.3. Size

This SHALL indicate the size of the image used for Styling different Video Player sections like Logo, Watermark etc.

6.7.5.8. DimensionStruct

This object defines dimension which can be used for defining Size of background images.

TODO : Evaluate if Dimension should be part of common data types. As of Apr 2021 adding it in ContentLauncher because we don't have any other usecases which require this datatype.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Width	double			ms	M
1	Height	double			ms	M
2	Metric	MetricType-Enum				M

6.7.5.8.1. Width

This indicates the width using the metric defined in Metric

6.7.5.8.2. Height

This indicates the height using the metric defined in Metric

6.7.5.8.3. Metric

This SHALL indicate metric used for defining Height/Width.

6.7.5.9. MetricTypeEnum

MetricTypeEnum Data Type is derived from enum8.

Value	Name	Conformance
0	Pixels	M
1	Percentage	M

6.7.5.9.1. Pixels

This value is used for dimensions defined in a number of Pixels.

6.7.5.9.2. Percentage

This value is for dimensions defined as a percentage of the overall display dimensions. For example, if using a Percentage Metric type for a Width measurement of 50.0, against a display width of 1920 pixels, then the resulting value used would be 960 pixels (50.0% of 1920) for that dimension. Whenever a measurement uses this Metric type, the resulting values SHALL be rounded ("floored") towards 0 if the measurement requires an integer final value.

6.8. Keypad Input Cluster

This cluster provides an interface for key code based input and control on a device like a Video Player or an endpoint like a Content App. This may include text or action commands such as UP, DOWN, and SELECT.

6.8.1. Overview

This cluster would be supported on Video Player devices as well as devices that support remote control input from a keypad or remote. This cluster provides the list of supported keypad inputs and provides a command for sending them.

The cluster server for Keypad Input is implemented by a device that can receive keypad input, such as a Video Player, or an endpoint that can receive keypad input, such as a Content App.

The key codes used are those defined in the HDMI CEC specification (see [HDMI](#)).

Devices MAY understand a subset of these key codes. Feature flags are used to indicate a specific subset that is supported. Device MAY support additional codes beyond what is indicated in feature flags.

6.8.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.8.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	KEYPADINPUT

6.8.1.3. Cluster Identifiers

Identifier	Name
0x0509	Keypad Input

6.8.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description
0	NV	Navigation KeyCodes	Supports UP, DOWN, LEFT, RIGHT, SELECT, BACK, EXIT, MENU
1	LK	Location Keys	Supports CEC keys 0x0A (Settings) and 0x09 (Home)
2	NK	Number Keys	Supports numeric input 0..9

6.8.3. Commands

Id	Name	Direction	Response	Access	Conformance
0x00	SendKey	Client ⇒ Server	SendKeyRe- sponse	O	M
0x01	SendKeyRe- sponse	Server ⇒ Client	N		M

6.8.3.1. SendKey Command

Upon receipt, this SHALL process a keycode as input to the media device.

If a second SendKey request with the same KeyCode value is received within 200ms, then the endpoint will consider the first key press to be a press and hold. When such a repeat KeyCode value is not received within 200ms, then the endpoint will consider the last key press to be a release.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	KeyCode	uint8	all			M

6.8.3.1.1. KeyCode

This SHALL indicate the key code to process.

6.8.3.2. SendKeyResponse Command

This command SHALL be generated in response to a SendKey command. The data for this command SHALL be as follows:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Status	StatusEnum	all			M

6.8.3.2.1. Status

This SHALL indicate the status of the command.

6.8.4. Data Types

6.8.4.1. StatusEnum

Status Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Success	M	Command succeeded
1	UnsupportedKey	M	Command failed: Key code is not supported.
2	InvalidKeyInCurrentState	M	Command failed: Requested key code is invalid in the context of the responder's current state.

6.9. Media Input Cluster

This cluster provides an interface for controlling the Input Selector on a media device such as a Video Player.

6.9.1. Overview

This cluster would be implemented on TV and other media streaming devices, as well as devices that provide input to or output from such devices.

This cluster provides the list of available inputs and provides commands for selecting and renaming them.

The cluster server for Media Input is implemented by a device that has selectable input, such as a Video Player device.

6.9.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.9.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	MEDIAINPUT

6.9.1.3. Cluster Identifiers

Identifier	Name
0x0507	Media Input

6.9.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description
0	NU	Name Updates	Supports updates to the input names

6.9.3. Attributes

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	InputList	list[InputInfoStruct]				R V	M
0x0001	CurrentInput	uint8	all			R V	M

6.9.3.1. InputList Attribute

This list provides the media inputs supported by the device.

6.9.3.2. CurrentInput Attribute

This field contains the value of the index field of the currently selected *InputInfoStruct*.

6.9.4. Commands

Id	Name	Direction	Response	Access	Conformance
0x00	SelectInput	Client ⇒ Server	Y	O	M
0x01	ShowInputStatus	Client ⇒ Server	Y	O	M
0x02	HideInputStatus	Client ⇒ Server	Y	O	M
0x03	RenameInput	Client ⇒ Server	Y	M	NU

6.9.4.1. SelectInput Command

Upon receipt, this SHALL change the media input on the device to the input at a specific index in the Input List.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Index	uint8	all			M

6.9.4.1.1. Index

This SHALL indicate the index field of the *InputInfoStruct* from the InputList attribute in which to change to.

6.9.4.2. ShowInputStatus Command

Upon receipt, this SHALL display the active status of the input list on screen.

6.9.4.3. HideInputStatus Command

Upon receipt, this SHALL hide the input list from the screen.

6.9.4.4. RenameInput Command

Upon receipt, this SHALL rename the input at a specific index in the Input List.

Updates to the input name SHALL appear in the device's settings menus.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Index	uint8	all			M
1	Name	string	all			M

6.9.5. Data Types

6.9.5.1. InputInfoStruct

This contains information about an input.

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Index	uint8	all			M
1	InputType	InputType-Enum	desc			M
2	Name	string				M
3	Description	string				M

6.9.5.1.1. Index

This SHALL indicate the unique index into the list of Inputs.

6.9.5.1.2. InputType

This SHALL indicate the type of input

6.9.5.1.3. Name

This SHALL indicate the input name, such as “HDMI 1”. This field may be blank, but SHOULD be provided when known.

6.9.5.1.4. Description

This SHALL indicate the user editable input description, such as “Living room Playstation”. This field may be blank, but SHOULD be provided when known.

6.9.5.2. InputTypeEnum

InputType Data Type is derived from enum8.

The type of input, expressed as an enum, with the following values:

Value	Name	Conformance	Description
0	Internal	M	Indicates content not coming from a physical input.
1	Aux	M	
2	Coax	M	
3	Composite	M	
4	HDMI	M	

Value	Name	Conformance	Description
5	Input	M	
6	Line	M	
7	Optical	M	
8	Video	M	
9	SCART	M	
10	USB	M	
11	Other	M	

6.10. Media Playback Cluster

This cluster provides an interface for controlling Media Playback (PLAY, PAUSE, etc) on a media device such as a TV, Set-top Box, or Smart Speaker.

6.10.1. Overview

This cluster server would be supported on Video Player devices or endpoints that provide media playback, such as a Content App. This cluster provides an interface for controlling Media Playback.

6.10.1.1. Revision History

The global ClusterRevision attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.10.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	MEDIAPLAYBACK

6.10.1.3. Cluster Identifiers

Identifier	Name
0x0506	Media Playback

6.10.2. Features

This cluster SHALL support the FeatureMap bitmap attribute as defined below.

Bit	Code	Feature	Description
0	AS	Advanced Seek	Enables clients to implement more advanced media seeking behavior in their user interface, such as for example a "seek bar". Adds support for Attributes and Commands related to advanced seek support
1	VS	Variable Speed	Support for commands to support variable speed playback on media that supports it.

6.10.3. Attributes

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	Cur- rentState	Playback- StateEnum	desc			R V	M
0x0001	StartTime	epoch-us	desc	X	null	R V	AS
0x0002	Duration	uint64	desc	X	null	R V	AS
0x0003	Sampled- Position	Playback- Position- Struct	desc	X	null	R V	AS
0x0004	Playback- Speed	single	desc		0	R V	AS
0x0005	SeekRange End	uint64	desc	X	null	R V	AS
0x0006	SeekRange Start	uint64	desc	X	null	R V	AS

6.10.3.1. CurrentState Attribute

This SHALL indicate the current playback state of media.

During fast-forward, rewind, and other seek operations; this attribute SHALL be set to PLAYING.

6.10.3.2. StartTime Attribute

This SHALL indicate the start time of the media, in case the media has a fixed start time (for example, live stream or television broadcast), or null when start time does not apply to the current

media (for example, video-on-demand). This time is a UTC time. The client needs to handle conversion to local time, as required, taking in account time zone and possible local DST offset.

6.10.3.3. Duration Attribute

This SHALL indicate the duration, in milliseconds, of the current media being played back or null when duration is not applicable (for example, in live streaming content with no known duration). This attribute SHALL never be 0.

6.10.3.4. SampledPosition Attribute

This SHALL indicate the position of playback (**Position** field) at the time (**UpdateAt** field) specified in the attribute. The client MAY use the **SampledPosition** attribute to compute the current position within the media stream based on the **PlaybackSpeed**, **PlaybackPositionStruct.UpdatedAt** and **PlaybackPositionStruct.Position** fields. To enable this, the **SampledPosition** attribute SHALL be updated whenever a change in either the playback speed or the playback position is triggered outside the normal playback of the media. The events which MAY cause this to happen include:

- Starting or resumption of playback
- Seeking
- Skipping forward or backward
- Fast-forwarding or rewinding
- Updating of playback speed as a result of explicit request, or as a result of buffering events

6.10.3.5. PlaybackSpeed Attribute

This SHALL indicate the speed at which the current media is being played. The new **PlaybackSpeed** SHALL be reflected in this attribute whenever any of the following occurs:

- Starting of playback
- Resuming of playback
- Fast-forwarding
- Rewinding

The **PlaybackSpeed** SHALL reflect the ratio of time elapsed in the media to the actual time taken for the playback assuming no changes to media playback (for example buffering events or requests to pause/rewind/forward).

- A value for **PlaybackSpeed** of 1 SHALL indicate normal playback where, for example, playback for 1 second causes the media to advance by 1 second within the duration of the media.
- A value for **PlaybackSpeed** which is greater than 0 SHALL indicate that as playback is happening the media is currently advancing in time within the duration of the media.
- A value for **PlaybackSpeed** which is less than 0 SHALL indicate that as playback is happening the media is currently going back in time within the duration of the media.
- A value for **PlaybackSpeed** of 0 SHALL indicate that the media is currently not playing back. When the **CurrentState** attribute has the value of **PAUSED**, **NOT_PLAYING** or **BUFFERING**, the **Playba-**

Speed SHALL be set to 0 to reflect that the media is not playing.

Following examples illustrate the **PlaybackSpeed** attribute values in various conditions.

Seconds of Media Played	Actual Time Taken in Seconds	Direction of playback	PlaybackSpeed
2	2	Forward	1.0
2	1	Forward	2.0
1	2	Forward	0.5
2	2	Reverse	-1.0
2	1	Reverse	-2.0
1	2	Reverse	-0.5

6.10.3.6. SeekRangeStart Attribute

This SHALL indicate the earliest valid position to which a client MAY seek back, in milliseconds from start of the media. A value of Nas SHALL indicate that seeking backwards is not allowed.

6.10.3.7. SeekRangeEnd Attribute

This SHALL indicate the furthest forward valid position to which a client MAY seek forward, in milliseconds from the start of the media. When the media has an associated **StartTime**, a value of null SHALL indicate that a seek forward is valid only until the current time within the media, using a position computed from the difference between the current time offset and **StartTime**, in milliseconds from start of the media, truncating fractional milliseconds towards 0. A value of Nas when **StartTime** is not specified SHALL indicate that seeking forward is not allowed.

6.10.4. Commands

Id	Name	Direction	Response	Access	Conformance
0x00	Play	Client ⇒ Server	PlaybackRe- sponse	O	M
0x01	Pause	Client ⇒ Server	PlaybackRe- sponse	O	M
0x02	Stop	Client ⇒ Server	PlaybackRe- sponse	O	M
0x03	StartOver	Client ⇒ Server	PlaybackRe- sponse	O	O
0x04	Previous	Client ⇒ Server	PlaybackRe- sponse	O	O
0x05	Next	Client ⇒ Server	PlaybackRe- sponse	O	O

Id	Name	Direction	Response	Access	Conformance
0x06	Rewind	Client ⇒ Server	PlaybackRe- sponse	O	VS
0x07	FastForward	Client ⇒ Server	PlaybackRe- sponse	O	VS
0x08	SkipForward	Client ⇒ Server	PlaybackRe- sponse	O	O
0x09	SkipBackward	Client ⇒ Server	PlaybackRe- sponse	O	O
0x0a	PlaybackRe- sponse	Server ⇒ Client	N		M
0x0b	Seek	Client ⇒ Server	PlaybackRe- sponse	O	AS

6.10.4.1. Play Command

Upon receipt, this SHALL play media. If content is currently in a FastForward or Rewind state. Play SHALL return media to normal playback speed.

6.10.4.2. Pause Command

Upon receipt, this SHALL pause playback of the media.

6.10.4.3. Stop Command

Upon receipt, this SHALL stop playback of the media. User-visible outcome is context-specific. This MAY navigate the user back to the location from where the media was originally launched.

6.10.4.4. StartOver Command

Upon receipt, this SHALL Start Over with the current media playback item.

6.10.4.5. Previous Command

Upon receipt, this SHALL cause the handler to be invoked for "Previous". User experience is context-specific. This will often Go back to the previous media playback item.

6.10.4.6. Next Command

Upon receipt, this SHALL cause the handler to be invoked for "Next". User experience is context-specific. This will often Go forward to the next media playback item.

6.10.4.7. Rewind Command

Upon receipt, this SHALL start playback of the media backward in case the media is currently playing in the forward direction or is not playing. If the playback is already happening in the backwards direction receipt of this command SHALL increase the speed of the media playback back-

wards.

Different "rewind" speeds MAY be reflected on the media playback device based upon the number of sequential calls to this function and the capability of the device. This is to avoid needing to define every speed (multiple fast, slow motion, etc). If the **PlaybackSpeed** attribute is supported it SHALL be updated to reflect the new speed of playback. If the playback speed cannot be changed for the media being played(for example, in live streaming content not supporting seek), the status of **NOT_ALLOWED** SHALL be returned. If the playback speed has reached the maximum supported speed for media playing backwards, the status of **SPEED_OUT_OF_RANGE** SHALL be returned.

6.10.4.8. FastForward Command

Upon receipt, this SHALL start playback of the media in the forward direction in case the media is currently playing in the backward direction or is not playing. If the playback is already happening in the forward direction receipt of this command SHALL increase the speed of the media playback.

Different "fast-forward" speeds MAY be reflected on the media playback device based upon the number of sequential calls to this function and the capability of the device. This is to avoid needing to define every speed (multiple fast, slow motion, etc). If the **PlaybackSpeed** attribute is supported it SHALL be updated to reflect the new speed of playback. If the playback speed cannot be changed for the media being played(for example, in live streaming content not supporting seek), the status of **NOT_ALLOWED** SHALL be returned. If the playback speed has reached the maximum supported speed for media playing forward, the status of **SPEED_OUT_OF_RANGE** SHALL be returned.

6.10.4.9. SkipForward Command

Upon receipt, this SHALL Skip forward in the media by the given number of milliseconds, using the data as follows:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	DeltaPositionMilliseconds	uint64	all			M

6.10.4.9.1. DeltaPositionMilliseconds

This SHALL indicate the duration of the time span to skip forward in the media, in milliseconds. In case the resulting position falls in the middle of a frame, the server SHALL set the position to the beginning of that frame and set the **SampledPosition** attribute on the cluster accordingly. If the resultant position falls beyond the furthest valid position in the media the client MAY seek forward to, the position should be set to that furthest valid position. If the **SampledPosition** attribute is supported it SHALL be updated on the cluster accordingly.

6.10.4.10. SkipBackward Command

Upon receipt, this SHALL Skip backward in the media by the given number of milliseconds, using the data as follows:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	DeltaPositionMilliseconds	uint64	all			M

6.10.4.10.1. DeltaPositionMilliseconds

This SHALL indicate the duration of the time span to skip backward in the media, in milliseconds. In case the resulting position falls in the middle of a frame, the server SHALL set the position to the beginning of that frame and set the **SampledPosition** attribute on the cluster accordingly. If the resultant position falls before the earliest valid position to which a client MAY seek back to, the position should be set to that earliest valid position. If the **SampledPosition** attribute is supported it SHALL be updated on the cluster accordingly.

6.10.4.11. Seek Command

Upon receipt, this SHALL change the playback position in the media to the given position using data as follows:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Position	uint64	all			M

6.10.4.11.1. Position

This SHALL indicate the position (in milliseconds) in the media to seek to. In case the position falls in the middle of a frame, the server SHALL set the position to the beginning of that frame and set the **SampledPosition** attribute on the cluster accordingly. If the position falls before the earliest valid position or beyond the furthest valid position to which a client MAY seek back or forward to respectively, the status of **SEEK_OUT_OF_RANGE** SHALL be returned and no change SHALL be made to the position of the playback.

6.10.4.12. PlaybackResponse Command

This command SHALL be generated in response to various Playback Commands. The data for this command SHALL be as follows:

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Status	StatusEnum	desc			M
1	Data	octstr	any			O

6.10.4.12.1. Status

This SHALL indicate the status of the command which resulted in this response.

6.10.4.12.2. Data

This SHALL indicate Optional app-specific data.

6.10.5. Data Types

6.10.5.1. PlaybackStateEnum

PlaybackStateEnum Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Playing	M	Media is currently playing (includes FF and REW)
1	Paused	M	Media is currently paused
2	NotPlaying	M	Media is not currently playing
3	Buffering	M	Media is not currently buffering and playback will start when buffer has been filled

6.10.5.2. StatusEnum

Status Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Success	M	Command succeeded
1	InvalidStateForCommand	M	Command failed: Requested playback command is invalid in the current playback state.
2	NotAllowed	M	Command failed: Requested playback command is not allowed in the current playback state. For example, attempting to fast-forward during a commercial might return NotAllowed.

Value	Name	Conformance	Description
3	NotActive	M	Command failed: This endpoint is not active for playback.
4	SpeedOutOfRange	VS	Command failed: The FastForward or Rewind Command was issued but the media is already playing back at the fastest speed supported by the server in the respective direction.
5	SeekOutOfRange	AS	Command failed: The Seek Command was issued with a value of position outside of the allowed seek range of the media.

6.10.5.3. PlaybackPositionStruct

This structure defines a playback position within a media stream being played.

Id	Name	Type	Constraint	Quality	Default	Conformance
0	UpdatedAt	epoch-us	all			M
1	Position	uint64	all	X		M

6.10.5.3.1. UpdatedAt

This SHALL indicate the time when the position was last updated.

6.10.5.3.2. Position

This SHALL indicate the associated discrete position within the media stream, in milliseconds from the beginning of the stream, being associated with the time indicated by the **UpdatedAt** field. The Position SHALL not be greater than the duration of the media if duration is specified. The Position SHALL not be greater than the time difference between current time and start time of the media when start time is specified.

A value of null SHALL indicate that playback position is not applicable for the current state of the media playback (For example : Live media with no known duration and where seek is not supported).

6.11. Target Navigator Cluster

This cluster provides an interface for UX navigation within a set of targets on a device or endpoint.

6.11.1. Overview

This cluster would be supported on Video Player devices or devices with navigable user interfaces. This cluster would also be supported on endpoints with navigable user interfaces such as a Content App. It supports listing a set of navigation targets, tracking and changing the current target.

The cluster server for Target Navigator is implemented by endpoints on a device that support UX navigation.

When this cluster is implemented for a Content App endpoint, the Video Player device containing the endpoint SHALL launch the Content App when a client invokes the `NavigateTarget` command.

6.11.1.1. Revision History

The global `ClusterRevision` attribute value SHALL be the highest revision number in the table below.

Revision	Description
1	Initial Release

6.11.1.2. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	TGTNAV

6.11.1.3. Cluster Identifiers

Identifier	Name
0x0505	Target Navigator

6.11.2. Features

This cluster SHALL support the `FeatureMap` bitmap attribute as defined below.

Bit	Code	Feature	Description

6.11.3. Attributes

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	TargetList	list[Target-InfoStruct]				R V	M

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0001	Current-Target	uint8	desc	X	null	R V	O

6.11.3.1. TargetList Attribute

The TargetList attribute SHALL represent a list of targets that can be navigated to within the experience presented to the user by the Endpoint (Video Player or Content App). The list SHALL not contain any entries with the same Identifier in the TargetInfoStruct object.

6.11.3.2. CurrentTarget Attribute

The CurrentTarget attribute SHALL represent the Identifier for the target which is currently in foreground on the corresponding Endpoint (Video Player or Content App), or null to indicate that no target is in the foreground.

When not null, the CurrentTarget SHALL be an Identifier value contained within one of the TargetInfoStruct objects in the TargetList attribute list.

6.11.4. Commands

Id	Name	Direction	Response	Access	Conformance
0x00	NavigateTarget	Client ⇒ Server	NavigateTargetResponse	O	M
0x01	NavigateTargetResponse	Server ⇒ Client	N		M

6.11.4.1. NavigateTarget Command

Upon receipt, this SHALL navigation the UX to the target identified.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	Target	uint8	all			M
1	Data	string			ms	O

6.11.4.1.1. Target

This SHALL indicate the Identifier for the target for UX navigation. The Target SHALL be an Identifier value contained within one of the TargetInfoStruct objects in the TargetList attribute list.

6.11.4.1.2. Data

This SHALL indicate Optional app-specific data.

6.11.4.2. NavigateTargetResponse Command

This command SHALL be generated in response to NavigateTarget command.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	Status	StatusEnum	all			M
1	Data	string	any		ms	O

6.11.4.2.1. Status

This SHALL indicate the status of the command.

6.11.4.2.2. Data

This SHALL indicate optional app-specific data.

6.11.5. Data Types

6.11.5.1. TargetInfoStruct

This indicates an object describing the navigable target.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Identifier	uint8	all			M
1	Name	string				M

6.11.5.1.1. Identifier

An unique id within the TargetList.

6.11.5.1.2. Name

A name string for the TargetInfoStruct.

6.11.5.2. StatusEnum

Status Data Type is derived from enum8.

Value	Name	Conformance	Description
0	Success	M	Command succeeded
1	TargetNotFound	M	Requested target was not found in the TargetList

Value	Name	Conformance	Description
2	NotAllowed	M	Target request is not allowed in current state.