Matter Application Cluster Specification

Version 1.2

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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.

Matter Application Clusters

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Revision History

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01	September 23, 2022	Version 1.0	Robert Szewczyk
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03	October 18, 2023	Version 1.2	Robert Szewczyk

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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-multiscreen.org/dial-registry/namespace-database	DIAL Registry
[HDMI]	https://hdmiforum.org/hdmi-forum-releases-version-2-1-hdmi-specification/	HDMI CEC specification
[WakeOnLAN]	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.
- Support for InflowError, DrainError, TempTooLow, TempTooHigh, and WaterLevelError alarms in Dishwasher Alarm 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 Control	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
n/a	Mode Base	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.
0x0060	Operational State	Commands and attributes for defining a device's operational state
n/a	Alarm Base	Base alarm cluster from which all alarms are derived

1.2. Identify Cluster

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 multicast 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).

1.2.1. 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

Revision	Description
2	CCB 2808
3	All Hubs changes
4	New data model format and notation; add IdentifyType

1.2.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Utility	Endpoint	I

1.2.3. Cluster ID

ID	Name
0x0003	Identify

1.2.4. Features

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

Bit	Code	Name	Summary
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. Data Types

1.2.5.1. IdentifyTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0x00	**None**	No presentation.	M
0x01	**LightOutput**	Light output of a lighting product.	M
0x02	**VisibleIndicator**	Typically a small LED.	M
0x03	**AudibleBeep**		M

Value	Name	Summary	Conformance
0x04	**Display**	Presentation will be visible on display screen.	M
0x05	**Actuator**	Presentation will be conveyed by actuator functionality such as through a window blind operation or in-wall relay.	M

1.2.5.2. EffectIdentifierEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0x00	**Blink**	e.g., Light is turned on/off once.	M
0x01	**Breathe**	e.g., Light is turned on/off over 1 second and repeated 15 times.	M
0x02	**Okay**	e.g., Colored light turns green for 1 second; non-colored light flashes twice.	M
0x0B	**ChannelChange**	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.	M
0xFE	**FinishEffect**	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.	M
0xFF	**StopEffect**	Terminate the effect as soon as possible.	M

1.2.5.3. EffectVariantEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0x00	**Default**	Indicates the default effect is used	M

1.2.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**IdentifyTime**	uint16	all		0	RW VO	M
0x0001	**IdentifyType**	IdentifyTypeEnum	desc		MS	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.

1.2.6.1. 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.

1.2.6.2. IdentifyType Attribute

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

This field SHALL contain one of the values defined in IdentifyTypeEnum. The value None SHALL NOT be used if the device is capable of presenting its identification state using one of the other methods defined in IdentifyTypeEnum.

1.2.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**Identify**	client ⇒ server	Y	M	M
0x01	**IdentifyQuery**	client ⇒ server	IdentifyQueryResponse	M	QRY

ID	Name	Direction	Response	Access	Conformance
0x40	**TriggerEffect**	client ⇒ server	Y	M	O
0x00	**Identify-QueryRe-sponse**	server ⇒ client	N		QRY

1.2.7.1. 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	Confor-mance
0	**Identify-Time**	uint16	all			M

1.2.7.1.1. 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.

1.2.7.2. IdentifyQuery Command

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

1.2.7.2.1. 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.

1.2.7.3. 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.

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**EffectIdentifier**	EffectIdentifierEnum	desc			M
1	**EffectVariant**	EffectVariantEnum	desc			M

1.2.7.3.1. EffectIdentifier Field

This field specifies the identify effect to use and SHALL contain one of the non-reserved values in EffectIdentifierEnum.

All values of the EffectIdentifierEnum SHALL be supported. Implementors MAY deviate from the example light effects in EffectIdentifierEnum, but they SHOULD indicate during testing how they handle each effect.

1.2.7.3.2. 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 in EffectVariantEnum.

1.2.7.3.3. 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.

1.2.7.4. IdentifyQueryResponse Command

This command is generated in response to receiving an 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

1.2.7.4.1. 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.

1.2.7.4.2. 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 Cluster

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.

Revision	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	Scope	PICS Code
Base	Utility	Endpoint	G

1.3.3. Cluster ID

ID	Name
0x0004	Groups

1.3.4. Features

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

Bit	Code	Feature	Summary
0	**GN**	GroupNames	The ability to store a name for a group.

1.3.4.1. GroupNames Feature

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

1.3.5. Data Types

1.3.5.1. NameSupportBitmap Type

This data type is derived from map8.

Bit	Name	Summary
7	**GroupNames**	The ability to store a name for a group.

1.3.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**NameSupport**	NameSupportBitmap	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 (GroupNames), SHALL be equal to bit 0 of the FeatureMap attribute (GN Feature). All other bits SHALL be 0.

1.3.7. Commands

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

ID	Name	Direction	Response	Access	Conformance
0x03	**RemoveGroup**	client ⇒ server	Remove-GroupRe-sponse	F M	M
0x04	**RemoveAll-Groups**	client ⇒ server	Y	F M	M
0x05	**AddGroupIfI-dentifying**	client ⇒ server	Y	F M	M
0x00	**AddGroupRe-sponse**	server ⇒ client	N		M
0x01	**ViewGroupRe-sponse**	server ⇒ client	N		M
0x02	**GetGroup-Member-shipResponse**	server ⇒ client	N		M
0x03	**Remove-GroupRe-sponse**	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.

ID	Name	Type	Constraint	Quality	Default	Confor-mance
0	**GroupID**	group-id	1 to max			M
1	**GroupName**	string	max 16			M

1.3.7.1.1. GroupID Field

This field SHALL be used to identify the group and any associated key material to which the server endpoint is to be added.

1.3.7.1.2. GroupName Field

This 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.

Support of group names is optional and is indicated by the FeatureMap and NameSupport attribute.

1.3.7.1.3. 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 response 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.

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 View-

GroupResponse 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 response 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.

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.

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 response 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.

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 Cluster).

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

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

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. GroupID Field

This field SHALL be used to identify the group and any associated key material to which the server endpoint is to be added.

1.3.7.6.2. GroupName Field

This 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.

Support of group names is optional and is indicated by the FeatureMap and NameSupport attribute.

1.3.7.6.3. 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 it 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.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Status**	enum8	desc			M

ID	Name	Type	Constraint	Quality	Default	Conformance
1	**GroupID**	group-id	1 to max			M

1.3.7.7.1. Status Field

This field is set according to the Effect on Receipt section of the AddGroup command.

1.3.7.7.2. GroupID Field

This 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.

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. Status Field

This field is according to the Effect on Receipt section of the ViewGroup command.

1.3.7.8.2. GroupID Field

This field is set to the GroupID field of the received ViewGroup command.

1.3.7.8.3. GroupName Field

If the status is SUCCESS, and group names are supported, this 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

1.3.7.9.1. Capacity Field

This 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 < 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.

1.3.7.9.2. GroupList Field

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.

1.3.7.10. RemoveGroupResponse Command

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

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. Status Field

This field is according to the Effect on Receipt section of the RemoveGroup command.

1.3.7.10.2. GroupID Field

This 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.

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: provisional
5	not provisional; Explicit, TableSize and FabricScenes features; support multi-fabric environment; adding attributes SceneTableSize and RemainingCapacity; add fabric-scoped scene information list

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	Feature	Conformance	Summary
0	**SN**	SceneNames	O	The ability to store a name for a scene.
1	**EX**	Explicit	M	Use explicit attribute IDs, not implicit based on order
2	**TS**	TableSize	M	Table size and remaining capacity supported

Bit	Code	Feature	Conformance	Summary
3	**FS**	FabricScenes	M	Supports current scene, count, group etc, as fabric-scoped.

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

1.4.4.1. SceneNames Feature

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

1.4.4.2. FabricScenes Feature

This feature supports a list of fabric-scoped structs that have current scene information.

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. Handling of fabric-scoping

To retain semantic equivalence to earlier versions of the Scenes cluster which were designed prior to the introduction of multiple fabrics, the behavior of fabric-scoping in this cluster replaces use of explicit fabric-scoped access quality with an implicit method.

In nodes supporting fabrics, attributes and commands for this cluster are scoped to the accessing fabric and SHALL only affect or reflect data related to the accessing fabric.

In nodes supporting fabrics, the following constraints apply in addition to any other stated requirements in individual data model elements:

- Any attribute read, attribute write or command invoked on the server when no accessing fabric is available SHALL fail with a status code of UNSUPPORTED_ACCESS returned to the client.
- When accessing scene information, implementations SHALL ensure that scenes with identical Group ID and Scene ID across fabrics will only access the data for the accessing fabric, so that the same identifier values used by different accessing fabrics do not cause mixing or overwriting of another fabric's scenes.
- Upon leaving a fabric with the RemoveFabric command of the Operational Credentials Cluster, all scenes data for the associated fabric SHALL be removed from the Scene Table.
- The Scene Table capacity for a given fabric SHALL be less than half (rounded down towards 0) of the Scene Table entries (as indicated in the SceneTableSize attribute), with a maximum of 253 entries (to allow expressing it in the GetSceneMembershipResponse command). If the Scene Ta-

ble capacity is about to be exceeded by adding or storing a scene, then the resource exhaustion behavior of the associated command SHALL apply.

1.4.7. Data Types

1.4.7.1. SceneInfoStruct Type

Except for RemainingCapacity, the fields in this struct are used in place of the attributes of the same name to indicate the current state on the scene on the server, when the FabricScenes feature is supported. A reference to one of the attributes with the same name in behavior text, is synonymous with a reference to the field with the same name.

Access Quality: Fabric Scoped							
ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	SceneCount	uint8	all		0	R V	M
1	CurrentScene	uint8	all		0	R V S	M
2	CurrentGroup	group-id	all		0	R V S	M
3	SceneValid	bool	all		False	R V S	M
4	RemainingCapacity	uint8	max 253		MS	R V	TS

1.4.7.1.1. SceneCount Field

See the SceneCount attribute.

1.4.7.1.2. CurrentScene Field

See the CurrentScene attribute.

1.4.7.1.3. the CurrentGroup Field

See CurrentGroup attribute.

1.4.7.1.4. SceneValid Field

See the SceneValid attribute.

1.4.7.1.5. RemainingCapacity Field

This field SHALL indicate the remaining capacity of the Scene Table on this endpoint for the accessing fabric. Note that this value may change between reads even if no entries are added or deleted on the accessing fabric due to other clients associated with other fabrics adding or deleting entries that impact the resource usage on the device.

1.4.7.2. CopyModeMap Type

The CopyModeMap type is used in the CopyScene command. The data type of the CopyModeMap is derived from map8.

Bit	Description	Default	Conformance
0	CopyAllScenes	0	M

1.4.7.3. AttributeValuePairStruct Type

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

ID	Name	Type	Constraint	Quality	Access	Default	Conformance
0	**AttributeID**	attribute-id	all		RW		EX, O
1	**ValueUnsigned8**	uint8			RW		O.a
2	**ValueSigned8**	int8			RW		O.a
3	**ValueUnsigned16**	uint16			RW		O.a
4	**ValueSigned16**	int16			RW		O.a
5	**ValueUnsigned32**	uint32			RW		O.a
6	**ValueSigned32**	int32			RW		O.a
7	**ValueUnsigned64**	uint64			RW		O.a
8	**ValueSigned64**	int64			RW		O.a

1.4.7.3.1. AttributeID Field

This field SHALL be present for all instances in a given ExtensionFieldSetStruct (explicit list) or SHALL be absent for all instances in a given ExtensionFieldSetStruct (implicit list).

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 for the ClusterID present in an ExtensionFieldSetStruct. Otherwise the data type of AttributeValue SHALL be the data type of the attribute indicated by AttributeID.

The AttributeID field SHALL NOT refer to an attribute without the Scenes ("S") designation in the Quality column of the cluster specification.

1.4.7.3.2. ValueUnsigned8, ValueSigned8, ValueUnsigned16, ValueSigned16, ValueUnsigned32, ValueSigned32, ValueUnsigned64, ValueSigned64 Fields

This is the attribute value as part of an extension field set, associated with a given AttributeID under an ExtensionFieldSetStruct's ClusterID. The proper field SHALL be present that maps to the data type of the attribute indicated (implicit or explicit).

- Data types bool, map8, and uint8 SHALL map to ValueUnsigned8.
- Data types int8 SHALL map to ValueSigned8.
- Data types map16 and uint16 SHALL map to ValueUnsigned16.
- Data types int16 SHALL map to ValueSigned16.
- Data types map32, uint24, and uint32 SHALL map to ValueUnsigned32.
- Data types int24 and int32 SHALL map to ValueSigned32.
- Data types map64, uint48, uint56 and uint64 SHALL map to ValueUnsigned64.
- Data types int48, int56 and int64 SHALL map to ValueSigned64.
- For nullable attributes, any value that is not a valid numeric value for the attribute's type after accounting for range reductions due to being nullable and constraints SHALL be considered to have the null value for the type.
- For non-nullable attributes, any value that is not a valid numeric value for the attribute's type after accounting for constraints SHALL be considered to have the maximum legal value in the attribute's constrained range.

Examples of processing are:

- ColorControl cluster CurrentX (AttributeID 0x0003) has a type of uint16 and is not nullable.
  - AttributeValue of 0xAB12 would be used as-is, as it is in range.
  - AttributeValue of 0xAA0011 is outside of the range of uint16, and would be saturated to the maximum of the attribute's constraint range: 0xFEFF.
- LevelControl cluster CurrentLevel (AttributeID 0x0000) has a type of uint8 and is nullable.
  - AttributeValue of 0xA1 would be used as-is, as it is in range.
  - AttributeValue of 0xBB12 is outside the range of nullable uint8, and would be considered as the null value.

1.4.7.4. ExtensionFieldSetStruct Type

This data type indicates for a given cluster a set of attributes and their values.

ID	Name	Type	Constraint	Quality	Access	Default	Conformance
0	**ClusterID**	cluster-id	all		RW		M
1	**AttributeValueList**	list[AttributeValuePairStruct]	desc		RW		M

1.4.7.4.1. ClusterID Field

This field SHALL indicate the cluster-id of the cluster whose attributes are in the AttributeValueList field.

1.4.7.4.2. AttributeValueList Field

This field SHALL indicate a set of attributes and their values which are stored as part of a scene.

Attributes which do not have the Scenes ("S") designation in the Quality column of their cluster specification SHALL NOT be used in the AttributeValueList field.

The ExtensionFieldSetStruct can appear in an implicit form and an explicit form.

1.4.7.4.3. Implicit Form of ExtensionFieldSetStruct

In the implicit form, the AttributeValuePairStructs in AttributeValueList SHALL NOT have an AttributeID and the order of items in the AttributeValueList SHALL match the Scene Table order defined in the specification of the cluster identified by ClusterID. Note that the specified order of attributes in an AttributeValueList may not be the same as the order of attribute IDs.

The AttributeValueList SHOULD contain all the attributes with the Scenes ("S") quality as the specification of the cluster identified by ClusterID describes, but trailing AttributeValuePairStruct MAY be omitted. However, this restricts which AttributeValuePairStruct can be left out, imposing a problem for clusters that have attributes that have the Scenes ("S") quality but are not implemented, or for attributes which are a 'don’t care' in the given AttributeValueList. For these situations, the specification of the cluster identified by ClusterID also defines default values for these attributes.

An example using the Color Control cluster using positional indices:

- Index 0: maps to Attribute 0x0003, CurrentX
- Index 1: maps to Attribute 0x0004, CurrentY
- Index 2: maps to Attribute 0x4000, EnhancedCurrentHue
- Index 3: maps to Attribute 0x0001, CurrentSaturation
- Index 4: maps to Attribute 0x4002, ColorLoopActive
- Index 5: maps to Attribute 0x4003, ColorLoopDirection
- Index 6: maps to Attribute 0x4004, ColorLoopTime
- Index 7: maps to Attribute 0x0007, ColorTemperatureMireds
- Index 8: maps to Attribute 0x4001, EnhancedColorMode

1.4.7.4.4. Explicit Form of ExtensionFieldSetStruct

In the explicit form, the AttributeValuePairStructs in AttributeValueList SHALL have an AttributeID and the items in the AttributeValueList MAY be in any order.

The AttributeValueList SHOULD contain all the attributes with the Scenes ("S") quality as the specification of the cluster identified by ClusterID describes, but AttributeValuePairStruct MAY be omitted.

An example using the Color Control cluster:

- Attribute 0x0001, CurrentSaturation, S quality, optional, implemented
- Attribute 0x0003, CurrentX, S quality, optional based on feature, implemented
- Attribute 0x0004, CurrentY, S quality, optional based on feature, implemented
- Attribute 0x0007, ColorTemperatureMireds, S quality, optional based on feature, implemented
- Attribute 0x4000, EnhancedCurrentHue, S quality, optional based on feature, implemented
- Attribute 0x4001, EnhancedColorMode, S quality, mandatory, implemented
- Attribute 0x4002, ColorLoopActive, S quality, optional based on feature, NOT implemented
- Attribute 0x4003, ColorLoopDirection, S quality, optional based on feature, NOT implemented
- Attribute 0x4004, ColorLoopTime, S quality, optional based on feature, NOT implemented

1.4.8. Attributes

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

Table 2. Scene Management Information Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	SceneCount	uint8	all		0	R V	!FS
0x0001	CurrentScene	uint8	all		0	R V	!FS
0x0002	CurrentGroup	group-id	all		0	R V	!FS
0x0003	SceneValid	bool	all		False	R V	!FS
0x0004	NameSupport	map8	desc		0	R V	M
0x0005	LastConfiguredBy	node-id	all	X	null	R V	O
0x0006	SceneTableSize	uint16	desc	F	16	R V	TS
0x0007	FabricSceneInfo	list[SceneInfoStruct]				R V F	FS

1.4.8.1. SceneCount Attribute

The SceneCount attribute specifies the number of scenes currently used in the server's Scene Table on the endpoint where the Scenes cluster appears.

For nodes supporting fabrics, this only includes the count for the accessing fabric.

1.4.8.2. CurrentScene Attribute

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

1.4.8.3. 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.

1.4.8.4. 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.

1.4.8.5. 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.

1.4.8.5.1. Scene Names Field

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

1.4.8.6. LastConfiguredBy Attribute

The LastConfiguredBy attribute holds the Node ID 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.

For nodes supporting fabrics, the Node ID is scoped to the accessing fabric.

1.4.8.7. SceneTableSize Attribute

This attribute SHALL indicate the number of entries in the Scene Table on this endpoint. For nodes supporting fabrics, this is the total across all fabrics; note that a single fabric cannot use all those entries (see Handling of fabric-scoping). The minimum size of this table, (i.e., the minimum number of scenes to support across all fabrics per endpoint) SHALL be 16, unless a device type in which this

cluster is used, defines a larger value in the device type definition.

1.4.8.8. FabricSceneInfo Attribute

This attribute indicates a list of fabric scoped information about scenes on this endpoint.

1.4.8.9. Logical 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 Scene Table is defined here as a conceptual illustration to assist in understanding the underlying data to be stored when scenes are defined. Though the Scene Table is defined here using the data model architecture rules and format, the design is not normative.

The Scene table is logically a list of fabric-scoped structs. The logical fields of each Scene Table entry struct are illustrated below. An ExtensionFieldSetStruct MAY be present for each Scenes-supporting cluster implemented on the same endpoint.

Table 3. Fields of a Scene Table Entry

Quality: Fabric-Scoped							
ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	SceneGroupID	group-id	all				M
1	SceneID	uint8	all				M
2	SceneName	string	max 16				SN
3	SceneTransitionTime	uint16	all		0		M
4	ExtensionFields	list[ExtensionFieldSetStruct]			empty		M
5	TransitionTime100ms	uint8	max 9		0		M

1.4.8.9.1. SceneGroupID Field

This field is the group identifier for which this scene applies, or 0 if the scene is not associated with a group.

1.4.8.9.2. SceneID Field

```
This field is unique within this group, which is used to identify this scene.
```

1.4.8.9.3. SceneName Field

The field is the name of the scene.

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 name SHALL return an empty string.

Note implementations before revision 5 may return the null string.

1.4.8.9.4. SceneTransitionTime Field

This field is the amount of time, in seconds, it will take for a cluster to change from its current state to the requested state.

1.4.8.9.5. ExtensionFields Field

See the Scene Table Extensions subsections of individual clusters. A Scene Table Extension SHALL only use attributes with the Scene quality. Each ExtensionFieldSetStruct holds a set of values of these attributes for a cluster implemented on the same endpoint where the Scene ("S") designation appears in the quality column. A scene is the aggregate of all such fields across all clusters on the endpoint.

1.4.8.9.6. TransitionTime100ms Field

Together with the SceneTransitionTime, this field allows the transition time to be specified in tenths of a second.

1.4.9. Commands

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

Table 4. 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	EnhancedViewScene	client ⇒ server	EnhancedViewSceneResponse	O	O

ID	Name	Direction	Response	Access	Conformance
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	RemoveAllScenesResponse	server ⇒ client	N		M
0x04	StoreSceneResponse	server ⇒ client	N		M
0x06	GetSceneMembershipResponse	server ⇒ client	N		M
0x40	EnhancedAddSceneResponse	server ⇒ client	N		EnhancedAddScene
0x41	Enhanced-ViewSceneResponse	server ⇒ client	N		Enhanced-ViewScene
0x42	CopySceneResponse	server ⇒ client	N		CopyScene

1.4.9.1. Generic Usage Notes

Scene identifier 0, when used 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	max 6000			M

Id	Name	Type	Constraint	Quality	Default	Conformance
3	SceneName	string	max 16			M
4	ExtensionFieldSetStructs	list[ExtensionFieldSetStruct]	desc			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 INVALID_COMMAND and the server continues from step 5.
2. If the ExtensionFieldSetStructs list is formatted in a way deemed invalid according to the ExtensionFieldSetStruct structure definition (see ExtensionFieldSetStruct Type), then the status SHALL be INVALID_COMMAND in the AddSceneResponse, and the server continues from step 5.
3. If a scene already exists under the same group/scene identifier pair, in step 4 the already existing scene entry SHALL be replaced with the new scene being added. Otherwise, if a scene cannot be created due to the lack of Scene Table capacity for the given fabric, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 5.
4. 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.
    a. Any ExtensionFieldSetStruct referencing a ClusterID that is not implemented on the endpoint MAY be omitted during processing.
    b. Any AttributeValuePairStruct referencing an AttributeID from the referenced cluster that is not implemented on the endpoint MAY be omitted during processing.
    c. If the ExtensionFieldSetStructs list has multiple entries listing the same ClusterID, the last one within the list SHALL be the one recorded.
    d. Within a single entry of the ExtensionFieldSetStructs list, if the explicit form contains the same AttributeID more than once, the last one within the list SHALL be the one recorded.
5. 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 INVALID_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.

Note: For the explicit form of ExtensionFieldSetStructs, the order of attributes within the ExtensionFieldSetStruct MAY differ in implementation-defined ways from any potential order given in a prior AddScene or EnhancedAddScene.

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 INVALID_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 INVALID_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 INVALID_COMMAND and the server continues from step 4.
2. If a scene already exists under the same group/scene identifier pair, in step 3 the already existing scene entry SHALL be used to store the current state.
   If a scene cannot be created due to the lack of Scene Table capacity for the given fabric, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 4.
3. If a scene already exists under the same group/scene identifier pair, the ExtensionFieldSets of the stored scene SHALL be replaced with the ExtensionFieldSets corresponding to the current state of other clusters on the same endpoint and the other fields of the scene table entry SHALL remain unchanged.
   Otherwise, a new entry SHALL be added to the scene table, using the provided GroupID and SceneID, with SceneTransitionTime and TransitionTime100ms set to 0, with SceneName set to the empty string, and with ExtensionFieldSets corresponding to the current state of other clusters on the same endpoint.
   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	max 60000	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 INVALID_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 field sets 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 attributes, the values of these attributes SHALL remain unchanged. If an extension field set would cause an unknown or missing attribute to be set for any reason, that attribute SHALL be skipped. The status SHALL be SUCCESS.
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 algorithm is implementation-defined.

1.4.9.8. GetSceneMembership Command

The GetSceneMembership command can be used 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 INVALID_COMMAND and the server continues from step 3.
    - The status SHALL be SUCCESS.
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 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	max 60000			M
3	SceneName	string	max 16			M
4	ExtensionFieldSetStructs	list[ExtensionFieldSetStruct]	desc			M

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

The meaning of the data fields for this command SHALL be the same as for 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 INVALID_COMMAND and the server continues from step 5.
2. If the ExtensionFieldSetStructs list is formatted in a way deemed invalid according to the ExtensionFieldSetStruct structure definition (see ExtensionFieldSetStruct Type), then the status SHALL be INVALID_COMMAND in the AddSceneResponse, and the server continues from step 5.
3. If a scene already exists under the same group/scene identifier pair, in step 4 the already existing scene entry SHALL be replaced with the new scene being added. Otherwise, if a scene cannot be created due to the lack of Scene Table capacity for the given fabric, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 5.
4. 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. The TransitionTime field (measured in tenths of a second) SHALL be separated into whole seconds for the SceneTransitionTime field and tenths of a second for the TransitionTime100ms field of the Scene Table entry, as specified.
    a. Any ExtensionFieldSetStruct referencing a ClusterID that is not implemented on the endpoint MAY be omitted during processing.
    b. Any AttributeValuePairStruct referencing an AttributeID from the referenced cluster that is not implemented on the endpoint MAY be omitted during processing.

c. If the ExtensionFieldSetStructs list has multiple entries listing the same ClusterID, the last one within the list SHALL be the one recorded.

d. Within a single entry of the ExtensionFieldSetStructs list, if the explicit form contains the same AttributeID more than once, the last one within the list SHALL be the one recorded.

5. 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 INVALID_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.

Note: For the explicit form of ExtensionFieldSetStructs, the order of attributes within the ExtensionFieldSetStruct MAY differ in implementation-defined ways from any potential order given in a prior AddScene or EnhancedAddScene.

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	CopyModeMap	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.

The CopyAllScenes bit of the Mode 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 bit 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 INVALID_-COMMAND and the server continues from step 5.

2. If the CopyAllScenes sub-field of the Mode field is set to 0, the server verifies that the scene entry corresponding to the GroupIdentifierFrom 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, 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 SHALL be 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.
   Regardless of the value of the CopyAllScenes subfield, if a scene already exists under the same group/scene identifier pair, it SHALL be replaced with the scene being copied.
   Regardless of the value of the CopyAllScenes subfield, if a scene cannot be copied due to the lack of Scene Table capacity for the given fabric, the status SHALL be RESOURCE_EXHAUSTED and the server continues from step 5. In this case, scenes already copied SHALL be kept.
4. The status SHALL be SUCCESS.
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 a 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	status	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	status	desc			M
1	GroupID	group-id	all			M
2	SceneID	uint8	all			M
3	TransitionTime	uint16	max 6000			desc
4	SceneName	string	max 16			desc
5	ExtensionFieldSetStructs	list[ExtensionFieldSetStruct]				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 ExtensionFieldSetStructs 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	status	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	status	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	status	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 INVALID_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	status	desc			M
1	Capacity	uint8	all	X		M
2	GroupID	group-id	all			M
3	SceneList	list[uint8]				Status==Success

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 < 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 INVALID_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.

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.

The EnhancedViewSceneResponse command SHALL have the following data fields:

Id	Name	Type	Constraint	Quality	Default	Conformance
0	Status	status	desc			M
1	GroupID	group-id	all			M
2	SceneID	uint8	all			M
3	TransitionTime	uint16	max 60000			desc
4	SceneName	string	max 16			desc
5	ExtensionFieldSetStructs	list[ExtensionFieldSetStruct]				desc

The meaning of the data fields for this command SHALL be the same as for the ViewSceneResponse command, except that the resolution of TransitionTime is 1/10ths of a second.

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 INVALID_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 ExtensionFieldSetStructs fields SHALL be present, otherwise they are omitted.

If present, 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, and the SceneName and ExtensionFieldSetStructs fields SHALL be copied from the corresponding fields of the Scene Table entry.

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	status	desc			M
1	GroupIdentifierFrom	group-id	all			M
2	SceneIdentifierFrom	uint8	all			M

1.4.9.20.1. When Generated

The CopySceneResponse command is generated in response to a received CopyScene command, see CopyScene Command. The Status field is set according to the Effect on Receipt section for the CopyScene command. 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 Cluster

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.

Revision	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
5	Addition of Dead Front behavior and associated FeatureMap entry

1.5.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	OO

1.5.3. Cluster ID

ID	Name
0x0006	On/Off

1.5.4. Features

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

Bit	Code	Feature	Summary
0	**LT**	Lighting	Behavior that supports lighting applications.
1	**DF**	DeadFrontBehaviour	Device has Dead Front behavior

1.5.4.1. 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.

1.5.4.2. DeadFrontBehaviour Feature

When this feature is supported, the device exposing this server cluster exhibits "dead front" behavior when the "OnOff" attribute is FALSE (Off). This "dead front" behavior includes:

- clusters other than this cluster that are also exposed MAY respond with failures to Invoke and Write interactions. Such failure responses when in a "dead front" SHALL be with an INVALID_IN_STATE status code.
- clusters other than this cluster MAY change the values of their attributes to best-effort values, due to the actual values not being defined or available in this state. Device type specifications that require support for the DF feature SHOULD define what these best-effort values are.
- Report Transactions SHALL continue to be generated. Such transactions MAY include best-effort values as noted above.
- Event generation logic for clusters other than this cluster is unchanged (noting possible use of best-effort attribute values as in the preceding bullets).

When this feature is supported and the OnOff attribute changes from TRUE to FALSE (e.g. when receiving an Off Command, or due to a manual interaction on the device), it SHALL start executing this "dead front" behavior.

When this feature is supported and the OnOff attribute changes from FALSE to TRUE (e.g. when receiving an On Command, or due to a manual interaction on the device), it SHALL stop executing this "dead front" behavior.

When this feature is supported, and any change of the "dead front" state leads to changes in attributes of other clusters due to the "dead front" feature, these attribute changes SHALL NOT be skipped or omitted from the usual processing associated with attribute changes. For example, if an attribute changes from value 4 to null on "dead front" behavior due to an Off command being received, this change SHALL be processed for reporting and subscriptions.

1.5.5. Data Types

1.5.5.1. OnOffControlBitmap Type

This data type is derived from map8.

Bit	Name	Summary	Conformance
0	**AcceptOnlyWhenOn**	Indicates a command is only accepted when in On state.	M

1.5.5.2. StartUpOnOffEnum Type

This data type is derived from enum8.

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

Value	Name	Summary	Conformance
2	**Toggle**	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).	M

1.5.5.3. EffectIdentifierEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0x00	DelayedAllOff	Delayed All Off	M
0x01	DyingLight	Dying Light	M

1.5.5.4. DelayedAllOffEffectVariantEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0x00	DelayedOffFastFade	Fade to off in 0.8 seconds	M
0x01	NoFade	No fade	M
0x02	DelayedOffSlowFade	50% dim down in 0.8 seconds then fade to off in 12 seconds	M

1.5.5.5. DyingLightEffectVariantEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0x00	DyingLightFadeOff	20% dim up in 0.5s then fade to off in 1 second	M

1.5.6. Attributes

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		0	RW VO	LT
0x4002	**OffWaitTime**	uint16	all		0	RW VO	LT
0x4003	**StartUpOnOff**	StartUpOnOffEnum	desc	XN	MS	RW VM	LT

1.5.6.1. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following attribute SHALL be part of the ExtensionFieldSetStruct of the Scene Table.

- OnOff

1.5.6.2. OnOff Attribute

This 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.

1.5.6.3. GlobalSceneControl Attribute

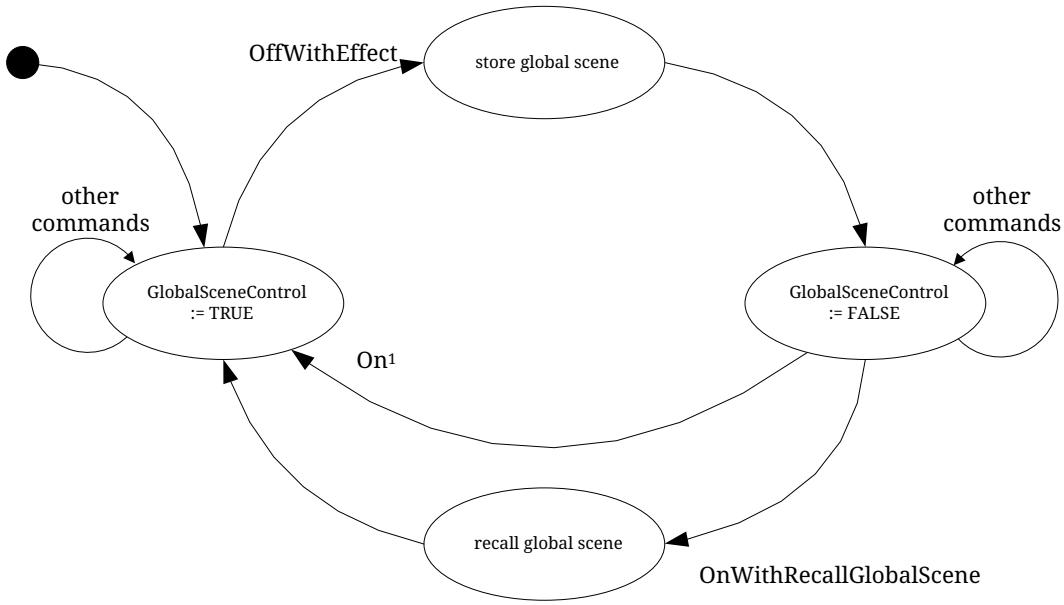
In order to support the use case where the user gets back the last setting of a set of devices (e.g. level settings for lights), a global scene is introduced which is stored when the devices are turned off and recalled when the devices are turned on. The global scene is defined as the scene that is stored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

This 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 current settings by going back to the global scene.

This 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.

This 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

1.5.6.4. OnTime Attribute

This 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 for more details.

1.5.6.5. OffWaitTime Attribute

This 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 for more details.

1.5.6.6. StartUpOnOff Attribute

This 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

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	**OnWithRecall-GlobalScene**	client ⇒ server	Y	O	LT
0x42	**OnWith-TimedOff**	client ⇒ server	Y	O	LT

1.5.7.1. Off Command

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

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

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**	EffectIdentifierEnum	desc			M
1	**EffectVariant**	enum8	desc		0	M

1.5.7.4.1. EffectIdentifier Field

This field specifies the fading effect to use when turning the device off. This field SHALL contain one of the non-reserved values listed in EffectIdentifierEnum.

1.5.7.4.2. EffectVariant Field

This 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 either DelayedAllOffEffectVariantEnum or DyingLightEffectVariantEnum.

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

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

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

This 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**	OnOffControlBitmap	0 to 1			M
1	**OnTime**	uint16	max 0xFFFE			M
2	**OffWaitTime**	uint16	max 0xFFFE			M

1.5.7.6.1. OnOffControl Field

This field contains information on how the server is to be operated.

1.5.7.6.1.1. AcceptOnlyWhenOn Bit

This bit 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

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

1.5.7.6.3. OffWaitTime Field

This 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.

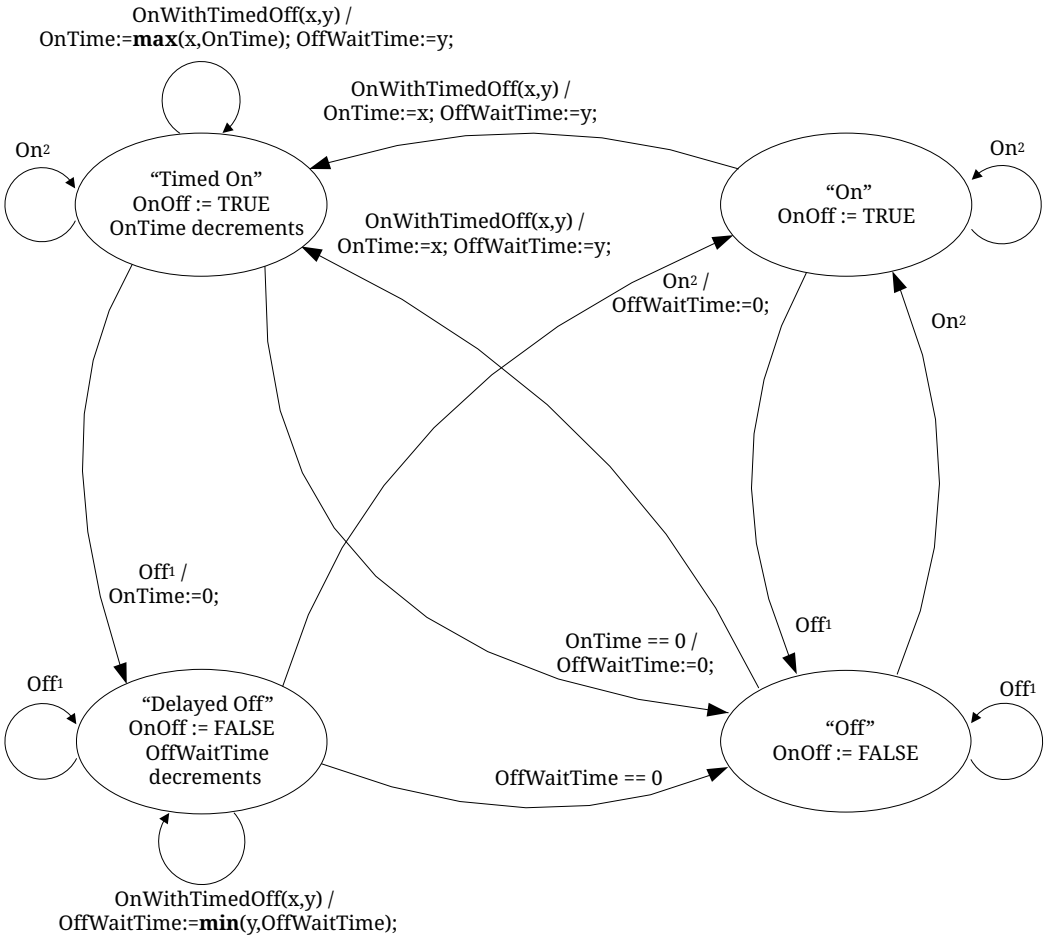
If the values of the OnTime and OffWaitTime attributes are both not equal to 0xFFFF, the server

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 0xFFFF. Similarly, in the Delayed Off state, the OffWaitTime attribute is decremented every 1/10th second, unless its value equals 0xFFFF.



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 Cluster

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.

Revision	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

Revision	Description
3	CCB 2574 2616 2659 2702 2814 2818 2819 2898
4	FeatureMap support with On/Off, Lighting and Frequency features
5	New data model format and notation

1.6.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	LVL

1.6.3. Cluster ID

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 of 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.

ID	Hierarchy	Name
0x0008	Base	Level Control
0x001C	Derived	Pulse Width Modulation

NOTE Pulse Width Modulation cluster is provisional.

1.6.4. Features

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

Bit	Code	Feature	Default	Summary
0	**OO**	OnOff	1	Dependency with the On/Off cluster
1	**LT**	Lighting	0	Behavior that supports lighting applications
2	**FQ**	Frequency	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 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 the Effect of On/Off Commands when associated with Level Control table. In this table, and throughout this cluster specification, 'level' means the value of the CurrentLevel attribute.

Table 5. Effect of 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.

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	The Frequency feature is provisional.

1.6.5. Data Types

1.6.5.1. OptionsBitmap Type

This data type is derived from map8.

Bit	Name	Summary	Conformance
0	**ExecuteIfOff**	Dependency on On/Off cluster	LT | OO
1	**CoupleColorTemp-ToLevel**	Dependency on Color Control cluster	LT

1.6.5.1.1. ExecuteIfOff Bit

This bit indicates if this cluster has a dependency with the On/Off cluster.

1.6.5.1.2. CoupleColorTempToLevel Bit

This bit indicates if this cluster has a dependency with the Color Control cluster.

1.6.5.2. MoveModeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Up**	Increase the level	M
1	**Down**	Decrease the level	M

1.6.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Confor-mance
0x0000	**Cur-rentLevel**	uint8	MinLevel to MaxLevel	SNX	null	R V	M
0x0001	**Remain-ingTime**	uint16	all		0	R V	LT
0x0002	**MinLevel**	uint8	1 to MaxLevel		1	R V	[LT]
0x0002	**MinLevel**	uint8	0 to MaxLevel		0	R V	[!LT]
0x0003	**MaxLevel**	uint8	MinLevel to 254		254	R V	O

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
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**	Options-Bitmap	desc		0	RW VO	M
0x4000	**StartUpCurrentLevel**	uint8	desc	XN	MS	RW VM	LT

1.6.6.1. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following attributes SHALL be part of the ExtensionFieldSetStruct of the Scene Table. If the implicit form of the ExtensionFieldSetStruct is used, the order of the attributes in the AttributeValueList is 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.

1.6.6.2. CurrentLevel Attribute

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

1.6.6.3. RemainingTime Attribute

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

1.6.6.4. MinLevel Attribute

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

1.6.6.5. MaxLevel Attribute

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

1.6.6.6. CurrentFrequency Attribute

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

1.6.6.7. 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.

1.6.6.8. 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.

1.6.6.9. 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.

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.

1.6.6.9.1. ExecuteIfOff Bit

If this bit is set, commands in this cluster are executed and potentially change the CurrentLevel attribute when the OnOff attribute of the On/Off cluster is FALSE.

1.6.6.9.2. CoupleColorTempToLevel Bit

If this bit is set, changes to the CurrentLevel attribute SHALL be coupled with the color temperature set in the Color Control cluster.

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

1.6.6.10. 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.

1.6.6.11. 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.

1.6.6.12. 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.

1.6.6.13. 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.

1.6.6.14. 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.

1.6.6.15. 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:

Value	Action on power up
0	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.

1.6.7. Commands

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	**MoveToLevel-WithOnOff**	client ⇒ server	Y	O	M
0x05	**MoveWith-OnOff**	client ⇒ server	Y	O	M
0x06	**StepWith-OnOff**	client ⇒ server	Y	O	M
0x07	**StopWith-OnOff**	client ⇒ server	Y	O	M
0x08	**MoveToClos-estFrequency**	client ⇒ server	Y	O	FQ

1.6.7.1. MoveToLevel Command

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Confor-mance
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**	OptionsBitmap	desc		0	M

1.6.7.1.1. 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 the 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.

1.6.7.2. Move Command

The Move command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**MoveMode**	MoveModeEnum	desc			M
1	**Rate**	uint8	all	X		M

ID	Name	Type	Constraint	Quality	Default	Conformance
2	**OptionsMask**	map8	desc		0	M
3	**OptionsOverride**	OptionsBitmap	desc		0	M

1.6.7.2.1. MoveMode Field

This field SHALL be one of the non-reserved values in MoveModeEnum.

1.6.7.2.2. Rate Field

This 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.

1.6.7.2.3. Effect on Receipt

On receipt of this command, a device SHALL first create and process a temporary Options bitmap as described in the MoveToLevel command.

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 below.

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.

1.6.7.3. Step Command

The Step command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**StepMode**	MoveModeEnum	desc			M
1	**StepSize**	uint8	all			M

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

1.6.7.3.1. StepMode Field

This field SHALL be one of the non-reserved values in MoveModeEnum.

1.6.7.3.2. StepSize Field

This field SHALL indicate the change to CurrentLevel.

1.6.7.3.3. TransitionTime Field

This 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.

1.6.7.3.4. Effect on Receipt

On receipt of this command, a device SHALL first create and process a temporary Options bitmap as described in the MoveToLevel command.

On receipt of this command, a device SHALL move from its current level in an up or down direction as detailed below.

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.

1.6.7.4. 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**	OptionsBitmap	desc		0	M

1.6.7.4.1. Effect of Receipt

On receipt of this command, a device SHALL first create and process a temporary Options bitmap as described in the MoveToLevel command.

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 the Commands list, 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.

1.6.7.5. MoveToClosestFrequency Command

The MoveToClosestFrequency command SHALL have the following data fields:

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

1.6.7.5.1. 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.

1.6.7.6. '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 end-

point, 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.

1.6.8. 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

1.6.8.1. Lighting Device State Change examples

CurrentLevel	**EiO**	**OnOff**	**Physical Device**	**Command Before After**	**CurrentLevel**	**OnOff**	**Physical Device**	**Device Output Result**
any	0	FALSE	Off	MoveToLevel(l=*MID*, t=2 sec)	*same*	FALSE	Off	Stays off
any	0	FALSE	Off	MoveToLevelWithOnOff(l=*MID*, t=2 sec	*MID*	TRUE	On (midpoint brightness)	Turns on and output level adjusts or stays at half
any	1	FALSE	Off	MoveToLevel(l=*MID*, t=2 sec)	*MID*	FALSE	Off	Stays off

CurrentLevel	**EiO**	**OnOff**	**Physical Device**	**Command Before After**	**CurrentLevel**	**OnOff**	**Physical Device**	**Device Output Result**
any	1	FALSE	Off	MoveToLevelWithOnOff(l=*MID*, t=2 sec)	*MID*	TRUE	On	Turns on and output 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	MoveWithOnOff(up, rate=64/s)	*MAX*	TRUE	On	Turn on and output level adjusts to or stays at full
any	1	FALSE	Off	MoveWithOnOff(down, rate=64/s)	*MIN*	FALSE	Off	Stays off
any	*any*	TRUE	On (any brightness)	MoveToLevelWithOnOff(l=*MID*, t=2 sec)	*MID*	TRUE	On (midpoint brightness)	Output level adjusts to or stays at half
any	*any*	TRUE	On (any brightness)	MoveWithOnOff(up, rate=64/s)	*MAX*	TRUE	On (full brightness)	Output level adjusts to or stays at full
any	*any*	TRUE	On (any brightness)	Move(down, rate=64/s)	*MIN*	TRUE	On (at minimum brightness)	Output level adjusts to minimum
any	*any*	TRUE	On (any brightness)	MoveWithOnOff(down, rate=64/s)	*MIN*	FALSE	Off	Output level adjusts to off

1.7. Boolean State Cluster

This cluster provides an interface to a boolean state.

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	Scope	PICS Code
Base	Application	Endpoint	BOOL

1.7.3. Cluster ID

ID	Name
0x0045	Boolean State

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.

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.

1.7.5. 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

1.7.5.1.1. StateValue Field

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

1.8. Mode Select Cluster

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 semantic 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.

Revision	Description
1	Initial version
2	The MfgCode field was marked non-nullable. Updated the related text. Reorder sections.

1.8.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	MOD

1.8.3. Cluster ID

ID	Name
0x0050	Mode Select

1.8.4. Features

This cluster SHALL support the FeatureMap global attribute:

ID	Code	Feature	Summary
0	**DEPONOFF**	OnOff	Dependency with the OnOff cluster

1.8.4.1. OnOff Feature

This feature creates a dependency between an OnOff cluster instance and this cluster instance on the same endpoint. See OnMode for more information.

1.8.5. Data Types

1.8.5.1. ModeOptionStruct

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

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Label**	string	max 64	F	MS	R	M
1	**Mode**	uint8		F	MS	R	M
2	**SemanticTags**	list[SemanticTagStruct]	max 64	F	MS	R	M

1.8.5.1.1. 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.

1.8.5.1.2. Mode Field

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

1.8.5.1.3. 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 SemanticTagStruct 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.

1.8.5.2. SemanticTagStruct

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

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

1.8.5.2.1. 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.

1.8.5.2.2. MfgCode Field

This field 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.

1.8.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**Description**	**string**	max 64	F	MS	R V	M
0x0001	**StandardNamespace**	**enum16**	desc	FX	null	R V	M
0x0002	**SupportedModes**	**list[ModeOptionStruct]**	max 255	F	MS	R V	M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0003	**CurrentMode**	**uint8**	desc	SN	MS	R V	M
0x0004	**StartUpMode**	**uint8**	desc	NX	MS	RW VO	O
0x0005	**OnMode**	**uint8**	desc	NX	null	RW VO	DEPONOFF

1.8.6.1. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following attribute SHALL be part of the ExtensionFieldSetStruct of the Scene Table.

- CurrentMode

1.8.6.2. 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.

1.8.6.3. 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.

1.8.6.4. 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.

1.8.6.5. 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.

1.8.6.6. 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 (see OnModeWithPowerUp).

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.

1.8.6.7. 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.

1.8.6.7.1. 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.

1.8.7. Commands

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

1.8.7.1. 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

1.9. Mode Base Cluster

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 mode's tags.

A mode 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 are no mode tags for the mode or none that are known to the client, the mode is anonymous, and the selection by the user can be made solely based on the Label string.

Any derived cluster specification based on this cluster SHALL support the standard mode tag value definitions and command status definitions defined in this cluster and MAY define additional standard mode tag values and standard command status values that are supported in the respective derived cluster instances.

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 NOT replace the meaning of a standard mode tag, when one exists, for the cluster purpose.

1.9.1. Revision History

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

Revision	Description
1	Initial version

1.9.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	MODB

1.9.3. Cluster ID

ID	Name
n/a	Mode Base

1.9.4. Features

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

Bit	Code	Feature	Summary
0	**DEPONOFF**	OnOff	Dependency with the OnOff cluster

1.9.4.1. OnOff Feature

This feature creates a dependency between an OnOff cluster instance and this cluster instance on the same endpoint. See OnMode for more information.

1.9.5. Data Types

1.9.5.1. ModeTagStruct Type

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

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**MfgCode**	vendor-id	desc			R	O
1	**Value**	enum16	all			R	M

1.9.5.1.1. MfgCode Field

If the MfgCode field exists, the Value field SHALL be in the manufacturer-specific value range (see Mode Namespace).

This field SHALL indicate the manufacturer's VendorID and it SHALL determine the meaning of the Value field.

The same manufacturer code and mode tag value in separate cluster instances are part of the same namespace and have the same meaning. For example: a manufacturer tag meaning "pinch" can be used both in a cluster whose purpose is to choose the amount of sugar, or in a cluster whose purpose is to choose the amount of salt.

1.9.5.1.2. Value Field

This field SHALL indicate the mode tag within a mode tag namespace which is either manufacturer specific or standard.

1.9.5.2. ModeOptionStruct Type

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

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Label**	string	max 64	F	MS	R	M
1	**Mode**	uint8		F	MS	R	M
2	**ModeTags**	list[ModeTagStruct]	max 8	F	MS	R	M

1.9.5.2.1. Label Field

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

1.9.5.2.2. Mode Field

This field is used to identify the mode option.

1.9.5.2.3. ModeTags Field

This field SHALL contain a list of tags that are associated with the mode option. This MAY be used by clients to determine the full or the partial semantics of a certain mode, depending on which tags they understand, using standard definitions and/or manufacturer specific namespace definitions.

The standard mode tags are defined in this cluster specification. For the derived cluster instances, if the specification of the derived cluster defines a namespace, the set of standard mode tags also includes the mode tag values from that namespace.

Mode tags can help clients look for options that meet certain criteria, render the user interface, use the mode in an automation, or to craft help text their voice-driven interfaces. A mode tag SHALL be either a standard tag or a manufacturer specific tag, as defined in each ModeTagStruct list entry.

A mode option MAY have more than one mode tag. A mode option MAY be associated with a mixture of standard and manufacturer specific mode tags.

A few examples are provided below.

- A mode named "100%" can have both the High (manufacturer specific) and Max (standard) mode tag. Clients seeking the mode for either High or Max will find the same mode in this case.
- A mode that includes a LowEnergy tag can be displayed by the client using a widget icon that shows a green leaf.
- A mode that includes a LowNoise tag may be used by the client when the user wishes for a lower level of audible sound, less likely to disturb the household's activities.
- A mode that includes a LowEnergy tag (standard, defined in this cluster specification) and also a Delicate tag (standard, defined in the namespace of a Laundry Washer Mode derived cluster).
- A mode that includes both a generic Quick tag (defined here), and Vacuum and Mop tags, (defined in the RVC Clean cluster that is a derivation of this cluster).

1.9.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**SupportedModes**	list[ModeOptionStruct]	2 to 255	F	MS	R V	M
0x0001	**CurrentMode**	uint8	desc	SN	MS	R V	M
0x0002	**StartUpMode**	uint8	desc	NX	MS	RW VO	O
0x0003	**OnMode**	uint8	desc	NX	null	RW VO	DEPONOFF

1.9.6.1. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following attribute SHALL be part of the ExtensionFieldSetStruct of the Scene Table.

- CurrentMode

1.9.6.2. SupportedModes Attribute

This attribute SHALL contain 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.

Each entry in this list SHALL have a unique value for the Label field.

1.9.6.3. CurrentMode Attribute

This attribute SHALL indicate the current mode of the server.

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

The value of this attribute may change at any time via an out-of-band interaction outside of the server, such as interactions with a user interface, via internal mode changes due to autonomously progressing through a sequence of operations, on system time-outs or idle delays, or via interactions coming from a fabric other than the one which last executed a ChangeToMode.

1.9.6.4. StartUpMode Attribute

This attribute SHALL indicate 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 (see OnModeWithPowerUp).

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.

1.9.6.5. OnMode Attribute

This attribute SHALL indicate whether the value of CurrentMode depends on the state of the On/Off cluster on the same endpoint. If this attribute is not present or is set to null, there is no dependency, otherwise the CurrentMode attribute SHALL depend on the OnOff attribute in 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.

1.9.6.5.1. 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.

1.9.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**ChangeToMode**	client ⇒ server	ChangeToModeResponse	O	M
0x01	**ChangeToModeResponse**	client ⇐ server	N	O	M

1.9.7.1. ChangeToMode Command

This command is used to change device modes.

On receipt of this command the device SHALL respond with a ChangeToModeResponse command.

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**NewMode**	uint8	desc			M

1.9.7.1.1. NewMode Field

If the NewMode field doesn't match the Mode field of any entry of the SupportedModes list, the ChangeToModeResponse command's Status field SHALL indicate UnsupportedMode and the StatusText field SHALL be included and MAY be used to indicate the issue, with a human readable string, or include an empty string.

If the NewMode field matches the Mode field of one entry of the SupportedModes list, but the device is not able to transition as requested, the ChangeToModeResponse command SHALL:

- Have the Status set to a product-specific Status value representing the error, or GenericFailure if a more specific error cannot be provided. See Status Field for details.
- Provide a human readable string in the StatusText field.

If the NewMode field matches the Mode field of one entry of the SupportedModes list and the device is able to transition as requested, the server SHALL transition into the mode associated with NewMode, the ChangeToModeResponse command SHALL have the Status field set to Success, the StatusText field MAY be supplied with a human readable string or include an empty string and the CurrentMode field SHALL be set to the value of the NewMode field.

If the NewMode field is the same as the value of the CurrentMode attribute the ChangeToModeResponse command SHALL have the Status field set to Success and the StatusText field MAY be supplied with a human readable string or include an empty string.

1.9.7.2. ChangeToModeResponse Command

This command is sent by the device on receipt of the ChangeToMode command. This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Status**	enum8	desc			M
1	**StatusText**	string	max 64			[Status == Success], M

1.9.7.2.1. Status Field

1.9.7.2.1.1. Mode Base Status Code Ranges

The following table defines the enumeration ranges for the ChangeToModeResponse command's Status field values.

Status Code Range	Range Name	Summary
0x00 to 0x3F	**CommonCodes**	Common standard values defined in the generic Mode Base cluster specification.
0x40 to 0x7F	**DerivedClusterCodes**	Derived cluster specific standard values defined in the derived Mode Base cluster specification.
0x80 to 0xBF	**MfgCodes**	Manufacturer specific values. For the derived Mode Base cluster instances, these are manufacturer specific under the derived cluster.

The set of Status field values defined in each of the generic or derived Mode Base cluster specifications is called StatusCode.

1.9.7.2.1.2. Mode Base Status CommonCodes Range

The following table defines the common StatusCode values.

Status Code	Name	Summary
0x00	**Success**	Switching to the mode indicated by the NewMode field is allowed and possible. The CurrentMode attribute is set to the value of the NewMode field.
0x01	**UnsupportedMode**	The value of the NewMode field doesn't match any entries in the SupportedMode attribute list.
0x02	**GenericFailure**	Generic failure code, indicating that switching to the mode indicated by the NewMode field is not allowed or not possible.
0x03	**InvalidInMode**	The received request cannot be handled due to the current mode of the device

The derived cluster code definitions SHALL NOT duplicate the common code definitions. For example, a derived cluster specification SHALL NOT define a status code with the same semantic as the common code of 0x01 (UnsupportedMode).

If the Status field is set to Success, the StatusText field is optional.

If the Status field is set to UnsupportedMode, the StatusText field SHALL be an empty string.

If the Status field is not set to Success or UnsupportedMode, the StatusText field SHALL include a vendor-defined error description which can be used to explain the error to the user.

If the Status field is set to InvalidInMode, the StatusText field SHALL be an empty string.

1.9.8. Mode Namespace

This section provides the definitions of the mode tag ranges and of the common standard mode tag values available in the instances of this cluster.

The following table defines the enumeration ranges for the ModeTagStruct Value field values.

Mode Tag Value Range	Range Name	Summary
0x0000 to 0x3FFF	**CommonTags**	Common standard values defined in this cluster specification.
0x4000 to 0x7FFF	**DerivedClusterTags**	Derived cluster specific standard values defined in the derived cluster specification.
0x8000 to 0xBFFF	**MfgTags**	Manufacturer-specific values. For the derived cluster instances, these are manufacturer specific under the derived cluster.

The derived cluster specific standard value definitions SHALL not duplicate the common standard value definitions. For example, a derived cluster specification can't define a mode tag value with the same mode as the common standard tag value of 0x0001 (Quick).

The set of ModeTagStruct Value field values defined in each of the generic or derived Mode Base cluster specifications is called ModeTag.

The following table defines the common ModeTag values.

Mode Tag Value	Name	Summary
0x0000	**Auto**	The device decides which options, features and setting values to use.
0x0001	**Quick**	The mode of the device is optimizing for faster completion.
0x0002	**Quiet**	The device is silent or barely audible while in this mode.
0x0003	**LowNoise**	Either the mode is inherently low noise or the device optimizes for that.

Mode Tag Value	Name	Summary
0x0004	**LowEnergy**	The device is optimizing for lower energy usage in this mode. Sometimes called "Eco mode".
0x0005	**Vacation**	A mode suitable for use during vacations or other extended absences.
0x0006	**Min**	The mode uses the lowest available setting value.
0x0007	**Max**	The mode uses the highest available setting value.
0x0008	**Night**	The mode is recommended or suitable for use during night time.
0x0009	**Day**	The mode is recommended or suitable for use during day time.

1.10. Low Power Cluster

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

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.

1.10.1. Revision History

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

Revision	Description
1	Initial Release

1.10.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	LOWPOWER

1.10.3. Cluster ID

ID	Name
0x0508	Low Power

1.10.4. Commands

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

1.10.4.1. Sleep Command

This command SHALL put the device into low power mode.

1.11. Wake On LAN Cluster

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]).

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 multicast-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.

1.11.1. 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	Scope	PICS Code
Base	Application	Endpoint	WAKEONLAN

1.11.3. Cluster ID

ID	Name
0x0503	Wake on LAN

1.11.4. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**MACAddress**	hwadr	desc	F		R V	O
0x0001	**LinkLocalAddress**	ipv6adr	desc	F		R V	O

1.11.4.1. MACAddress Attribute

This attribute 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.

1.11.4.2. LinkLocalAddress Attribute

This attribute 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.

1.12. Switch Cluster

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.

1.12.1. Revision History

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

Revision	Description
1	Initial Release

1.12.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	SWTCH

1.12.3. Cluster ID

ID	Name
0x003B	Switch

1.12.4. 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.

Bit	Code	Feature	Conformance	Summary
0	**LS**	LatchingSwitch	O.a	Switch is latching
1	**MS**	MomentarySwitch	O.a	Switch is momentary
2	**MSR**	MomentarySwitchRelease	[MS]	Switch supports release
3	**MSL**	MomentarySwitchLongPress	[MS & MSR]	Switch supports long press

Bit	Code	Feature	Conformance	Summary
4	**MSM**	MomentarySwitchMultiPress	[MS & MSR]	Switch supports multi-press

1.12.4.1. LatchingSwitch Feature

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

1.12.4.2. MomentarySwitch Feature

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.

1.12.4.3. MomentarySwitchRelease Feature

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.

1.12.4.4. MomentarySwitchLongPress Feature

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.

1.12.4.5. MomentarySwitchMultiPress Feature

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.

1.12.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
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

1.12.5.1. 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 Multi Position Details for the case NumberOfPositions>2.

1.12.5.2. 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.

1.12.5.3. 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).

1.12.6. Events

ID	Name	Priority	Access	Conformance
0x00	**SwitchLatched**	INFO	V	LS
0x01	**InitialPress**	INFO	V	MS
0x02	**LongPress**	INFO	V	MSL
0x03	**ShortRelease**	INFO	V	MSR
0x04	**LongRelease**	INFO	V	MSL
0x05	**MultiPressOngoing**	INFO	V	MSM
0x06	**MultiPressComplete**	INFO	V	MSM

1.12.6.1. 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	Quality	Default	Conformance
0	**NewPosition**	uint8	0 to NumberOfPositions-1			M

1.12.6.1.1. NewPosition Field

This field SHALL indicate the new value of the CurrentPosition attribute, i.e. after the move.

1.12.6.2. 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	Quality	Default	Conformance
0	**NewPosition**	uint8	0 to NumberOfPositions-1			M

1.12.6.2.1. NewPosition Field

This field SHALL indicate the new value of the CurrentPosition attribute, i.e. while pressed.

1.12.6.3. 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	Quality	Default	Conformance
0	**NewPosition**	uint8	0 to NumberOfPositions-1			M

1.12.6.3.1. NewPosition Field

This field SHALL indicate the new value of the CurrentPosition attribute, i.e. while pressed.

1.12.6.4. 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 1.12.7, “Sequence of generated events”.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**PreviousPosition**	uint8	0 to NumberOfPositions-1			M

1.12.6.4.1. PreviousPosition Field

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

1.12.6.5. 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 1.12.7, “Sequence of generated events”.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**PreviousPosition**	uint8	0 to NumberOfPositions-1			M

1.12.6.5.1. PreviousPosition Field

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

1.12.6.6. 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 Multi Press Details below.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**NewPosition**	uint8	0 to NumberOfPositions-1			M
1	**CurrentNumberOfPressesCounted**	uint8	2 to MultiPressMax			M

1.12.6.6.1. NewPosition Field

This field SHALL indicate the new value of the CurrentPosition attribute, i.e. while pressed.

1.12.6.6.2. CurrentNumberOfPressesCounted Field

This 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 N^{th} press of a multi-press sequence has been detected.

1.12.6.7. 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 Multi Press Details.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**PreviousPosition**	uint8	0 to NumberOfPositions-1			M
1	**TotalNumberOfPressesCounted**	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).

1.12.7. 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 Multi Position Details.

1.12.7.1. 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.

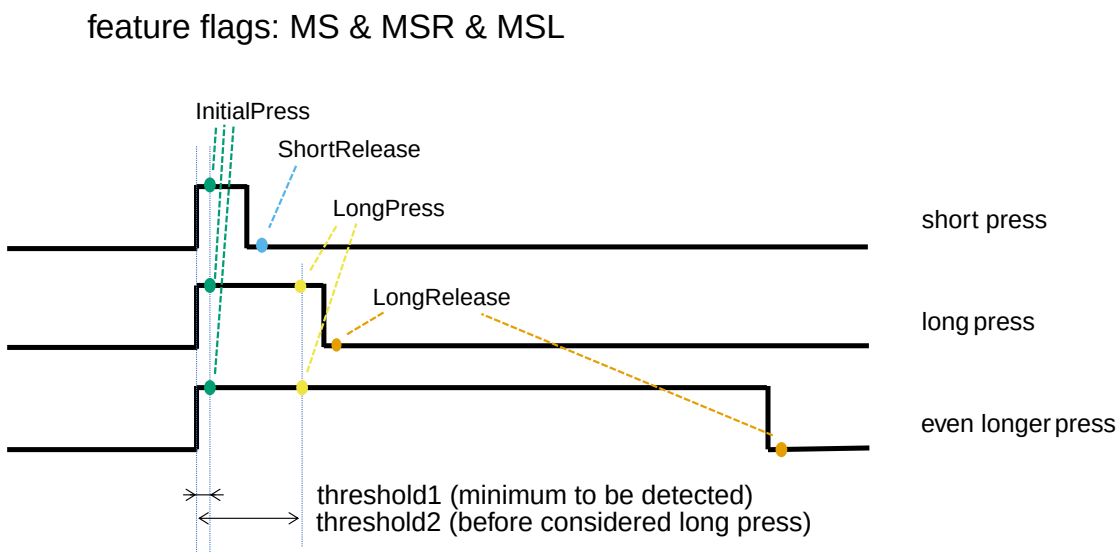


*Figure 3. Switch device delivering 'InitialPress', 'LongPress' and both '*Release' events*

1.12.7.2. 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.

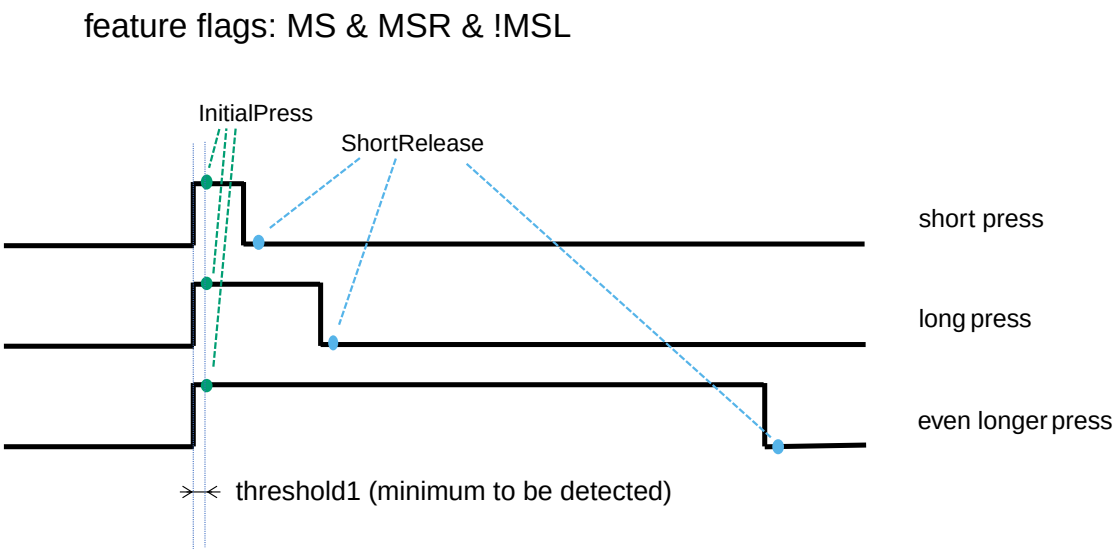


Figure 4. Switch device delivering only 'InitialPress' and 'ShortRelease' events

1.12.7.3. 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.

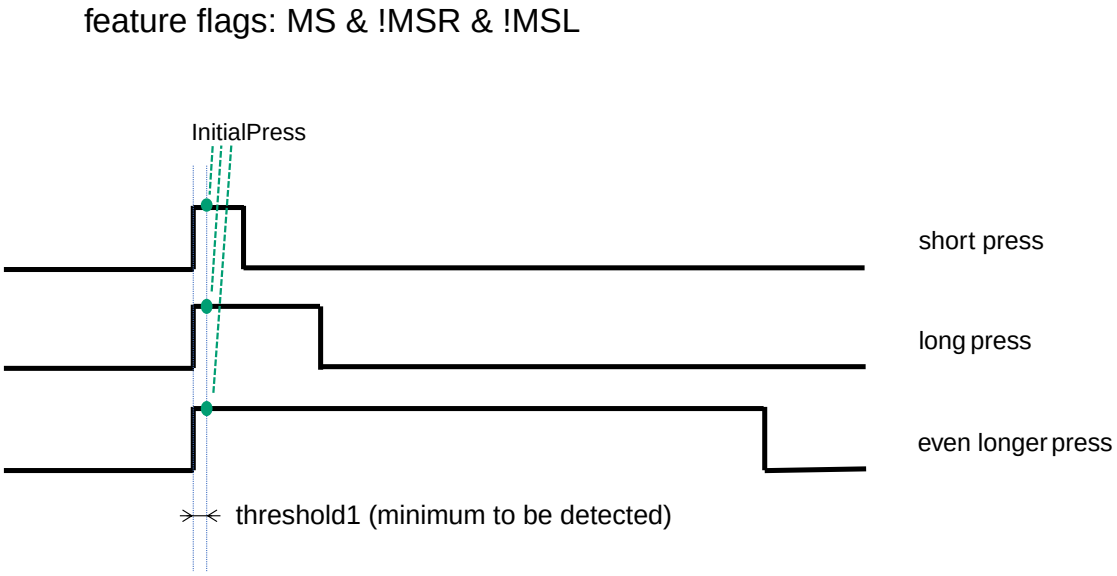


Figure 5. Switch device delivering only 'InitialPress' events

1.12.8. 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 suc-

cession. 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 take 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.

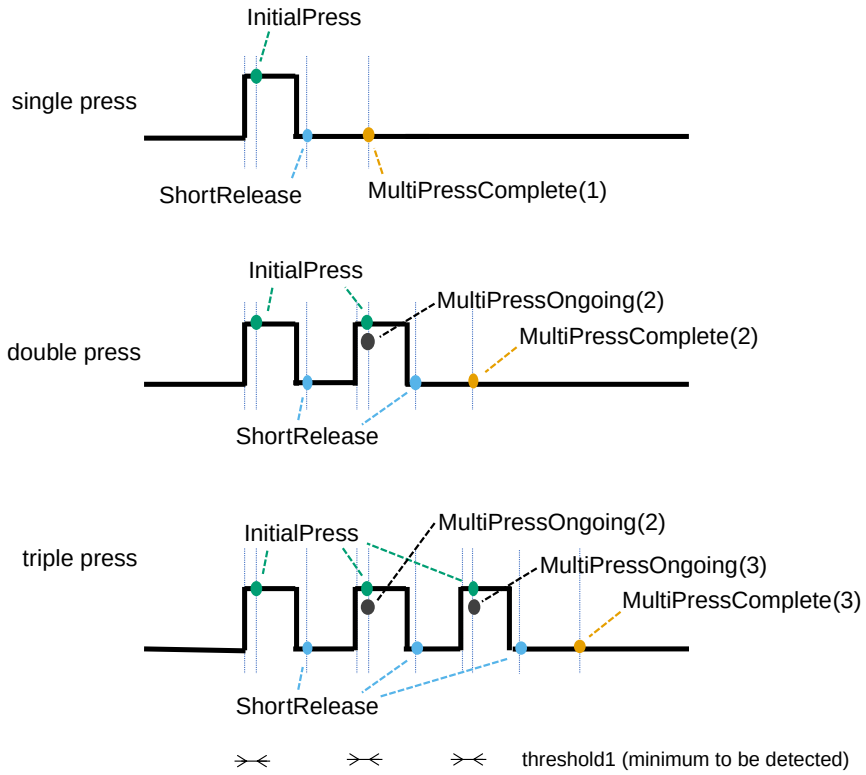


Figure 6. Switch device with multi-press events

1.12.9. Multi Position Details

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.

1.12.9.1. 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 New-Position 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.

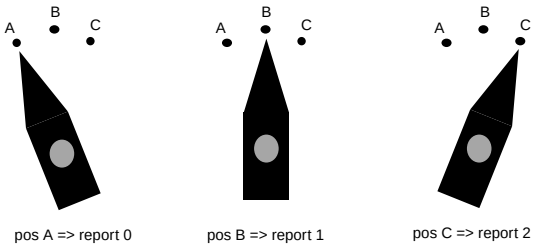


Figure 7. Rotary switch device with 3 positions

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.

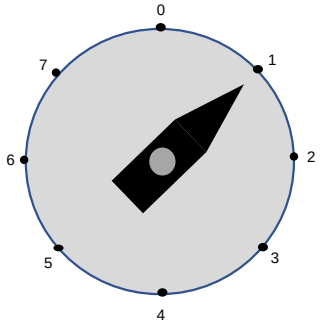


Figure 8. Rotary switch device with 8 positions and wraparound

1.12.9.2. 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

1.12.9.3. 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.

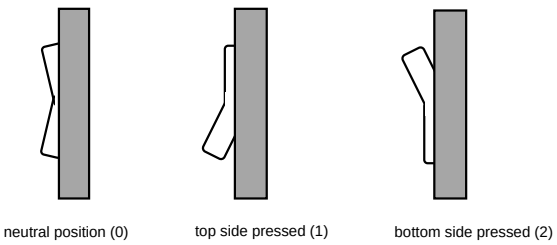


Figure 10. Up/down control switch device

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)
```

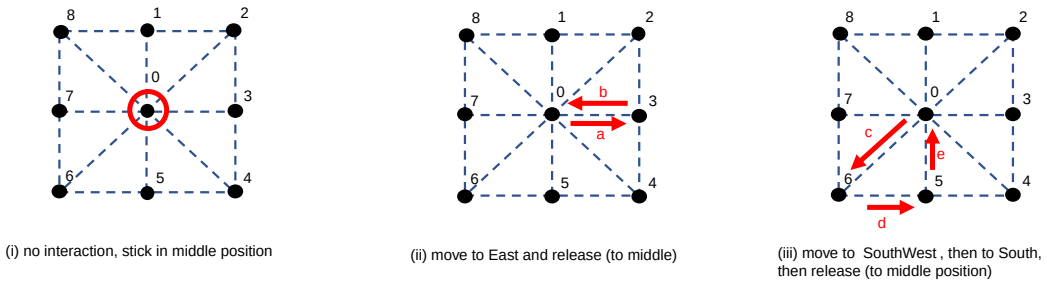


Figure 11. Switch device with joystick

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.

1.13. Operational State Cluster

This cluster supports remotely monitoring and, where supported, changing the operational state of any device where a state machine is a part of the operation.

This cluster defines common states, scoped to this cluster (e.g. Stopped, Running, Paused, Error). A derived cluster specification may define more states scoped to the derivation. Manufacturer specific states are supported in this cluster and any derived clusters thereof. When defined in a derived instance, such states are scoped to the derivation.

Actual state transitions are dependent on both the implementation, and the requirements that may additionally be imposed by a derived cluster.

An implementation that supports remotely starting its operation can make use of this cluster's Start command to do so. A device that supports remote pause or stop of its currently selected operation can similarly make use of this cluster's Pause and Stop commands to do so. The ability to remotely pause or stop is independent of how the operation was started (for example, an operation started by using a manual button press can be stopped by using a Stop command if the device supports remotely stopping the operation).

Additionally, this cluster provides events for monitoring the operational state of the device.

1.13.1. Revision History

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

Rev	Description
1	Initial release

1.13.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	OPSTATE

1.13.3. Cluster ID

ID	Name
0x0060	Operational State

1.13.4. Data Types

1.13.4.1. OperationalStateEnum Type

This type defines the set of known operational state values, and is derived from enum8. The following table defines the applicable ranges for values that are defined within this type. All values that are undefined SHALL be treated as reserved. As shown by the table, states that may be specific to a certain Device Type or other modality SHALL be defined in a derived cluster of this cluster.

Value	Name	Summary
0x00 to 0x3F	**GeneralStates**	Generally applicable values for state, defined herein
0x40 to 0x7F	**DerivedClusterStates**	Derived Cluster defined states
0x80 to 0xBF	**ManufacturerStates**	Vendor specific states

The derived cluster-specific state definitions SHALL NOT duplicate any general state definitions. That is, a derived cluster specification of this cluster cannot define states with the same semantics as the general states defined below.

A manufacturer-specific state definition SHALL NOT duplicate the general state definitions or derived cluster state definitions. That is, a manufacturer-defined state defined for this cluster or a derived cluster thereof cannot define a state with the same semantics as the general states defined below or states defined in a derived cluster.

The following table defines the generally applicable states.

Value	Name	Summary	Conformance
0x00	**Stopped**	The device is stopped	M
0x01	**Running**	The device is operating	M
0x02	**Paused**	The device is paused during an operation	M
0x03	**Error**	The device is in an error state	M

1.13.4.2. OperationalStateStruct Type

The OperationalStateStruct is used to indicate a possible state of the device.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**OperationalStateID**	OperationalStateEnum	all		0	M
1	**OperationalStateLabel**	string	max 64			desc

1.13.4.2.1. OperationalStateID Field

This SHALL be populated with a value from the OperationalStateEnum.

1.13.4.2.2. OperationalStateLabel Field

This field SHALL be present if the OperationalStateID is from the set reserved for Manufacturer Specific States, otherwise it SHALL NOT be present. If present, this SHALL contain a human-readable description of the operational state.

1.13.4.3. ErrorStateStruct Type

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**ErrorStateID**	enum8	all		0	M
1	**ErrorStateLabel**	string	max 64		empty	desc

ID	Name	Type	Constraint	Quality	Default	Conformance
2	**ErrorStateDetails**	string	max 64		empty	O

1.13.4.3.1. ErrorStateID Field

1.13.4.3.1.1. ErrorStateID Ranges

The following table defines the enumeration ranges for the ErrorStateID field values.

Value	Name	Summary
0x00 to 0x3F	**GeneralErrors**	Generally applicable values for error, defined herein
0x40 to 0x7F	**DerivedClusterErrors**	Derived Cluster defined errors
0x80 to 0xBF	**ManufacturerError**	Vendor specific errors

The derived cluster-specific error definitions SHALL NOT duplicate the general error definitions. That is, a derived cluster specification of this cluster cannot define errors with the same semantics as the general errors defined below.

The manufacturer-specific error definitions SHALL NOT duplicate the general error definitions or derived cluster-specific error definitions. That is, a manufacturer-defined error defined for this cluster or a derived cluster thereof cannot define errors with the same semantics as the general errors defined below or errors defined in a derived cluster.

The set of ErrorStateID field values defined in each of the generic or derived Operational State cluster specifications is called ErrorState.

1.13.4.3.1.2. ErrorStateID General Errors Range

The following table defines the generally applicable ErrorState values.

Value	Name	Summary	Conformance
0x00	**NoError**	The device is not in an error state	M
0x01	**UnableToStartOrResume**	The device is unable to start or resume operation	M
0x02	**UnableToCompleteOperation**	The device was unable to complete the current operation	M
0x03	**CommandInvalidInState**	The device cannot process the command in its current state	M

1.13.4.3.2. ErrorStateLabel Field

This field SHALL be present if the ErrorStateID is from the set reserved for Manufacturer Specific Errors, otherwise it SHALL NOT be present. If present, this SHALL contain a human-readable description of the ErrorStateID; e.g. for a manufacturer specific ErrorStateID of "0x80" the ErrorStateLabel MAY contain "My special error".

1.13.4.3.3. ErrorStateDetails Field

This SHALL be a human-readable string that provides details about the error condition. As an example, if the ErrorStateID indicates that the device is a Robotic Vacuum that is stuck, the ErrorStateDetails contains "left wheel blocked".

1.13.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**PhaseList**	list[string]	max 32[max 64]	X	MS	R V	M
0x0001	**CurrentPhase**	uint8	desc	X	MS	R V	M
0x0002	**CountdownTime**	elapsed-s	max 259200	X C	null	R V	O
0x0003	**OperationalStateList**	list[OperationalStateStruct]	desc		MS	R V	M
0x0004	**OperationalState**	OperationalStateEnum	all			R V	M
0x0005	**OperationalError**	ErrorStateStruct	desc			R V	M

1.13.5.1. PhaseList Attribute

This attribute SHALL indicate a list of names of different phases that the device can go through for the selected function or mode. The list may not be in sequence order. For example in a washing machine this could include items such as "pre-soak", "rinse", and "spin". These phases are manufacturer specific and may change when a different function or mode is selected.

A null value indicates that the device does not present phases during its operation. When this attribute's value is null, the CurrentPhase attribute SHALL also be set to null.

1.13.5.2. CurrentPhase Attribute

This attribute represents the current phase of operation being performed by the server. This SHALL be the positional index representing the value from the set provided in the PhaseList Attribute,

where the first item in that list is an index of 0. Thus, this attribute SHALL have a maximum value that is "length(PhaseList) - 1".

This attribute SHALL be null if the PhaseList attribute is null or if the PhaseList attribute is an empty list.

1.13.5.3. CountdownTime Attribute

This attribute SHALL represent the estimated time left before the operation is completed, in seconds. Changes to this value SHALL NOT be reported in a subscription (note the C Quality). A Client implementation MAY periodically poll this value to ensure alignment of any local rendering of the CountdownTime with the device provided value.

A value of 0 means that the operation has completed.

When this attribute is null, that represents that there is no time currently defined until operation completion. This MAY happen, for example, because no operation is in progress or because the completion time is unknown.

1.13.5.4. OperationalStateList Attribute

This attribute describes the set of possible operational states that the device exposes. An operational state is a fundamental device state such as Running or Error. Details of the phase of a device when, for example, in a state of Running are provided by the CurrentPhase attribute.

All devices SHALL, at a minimum, expose the set of states matching the commands that are also supported by the cluster instance, in addition to Error. The set of possible device states are defined in the OperationalStateEnum. A device type requiring implementation of this cluster SHALL define the set of states that are applicable to that specific device type.

1.13.5.5. OperationalState Attribute

This attribute specifies the current operational state of a device. This SHALL be populated with a valid OperationalStateID from the set of values in the OperationalStateList Attribute.

1.13.5.6. OperationalError Attribute

This attribute SHALL specify the details of any current error condition being experienced on the device when the OperationalState attribute is populated with Error. Please see ErrorStateStruct for general requirements on the population of this attribute.

When there is no error detected, this SHALL have an ErrorStateID of NoError.

1.13.6. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**Pause**	client ⇒ server	Operational-Comman-dResponse	O	Resume, O

ID	Name	Direction	Response	Access	Conformance
0x01	**Stop**	client ⇒ server	Operational-Comman-dResponse	O	Start, O
0x02	**Start**	client ⇒ server	Operational-Comman-dResponse	O	O
0x03	**Resume**	client ⇒ server	Operational-Comman-dResponse	O	Pause, O
0x04	**Operational-Comman-dResponse**	client ⇐ server	N	O	Pause | Stop | Start | Resume

Note that it is entirely possible due to regulatory or other reasons for an instance of this cluster to expose no possible commands. When that occurs, this cluster does not provide any ability to actuate the device, instead it provides readable (and by extension, can be subscribed to) information as to the state of the device only. The commands that are supported SHALL be exposed by the device in the AcceptedCommandList global attribute.

1.13.6.1. Pause Command

This command SHALL be supported if the device supports remotely pausing the operation. If this command is supported, the Resume command SHALL also be supported.

On receipt of this command, the device SHALL pause its operation if it is possible based on the current function of the server. For example, if it is at a point where it is safe to do so and/or permitted, but can be restarted from the point at which pause occurred.

If this command is received when already in the Paused state the device SHALL respond with an OperationalCommandResponse command with an ErrorStateID of NoError but take no further action.

A device that receives this command in any state other than Paused or Running SHALL respond with an OperationalCommandResponse command with an ErrorStateID of CommandInvalidInState but take no further action.

A device that is unable to honor the Pause command for whatever reason SHALL respond with an OperationalCommandResponse command with an ErrorStateID of CommandInvalidInState but take no further action.

Otherwise, on success:

- The OperationalState attribute SHALL be set to Paused.
- The device SHALL respond with an OperationalCommandResponse command with an ErrorStateID of NoError.

1.13.6.2. Stop Command

This command SHALL be supported if the device supports remotely stopping the operation.

On receipt of this command, the device SHALL stop its operation if it is at a position where it is safe to do so and/or permitted. Restart of the device following the receipt of the Stop command SHALL require attended operation unless remote start is allowed by the device type and any jurisdiction governing remote operation of the device.

If this command is received when already in the Stopped state the device SHALL respond with an OperationalCommandResponse command with an ErrorStateID of NoError but take no further action.

A device that is unable to honor the Stop command for whatever reason SHALL respond with an OperationalCommandResponse command with an ErrorStateID of CommandInvalidInState but take no further action.

Otherwise, on success:

- The OperationalState attribute SHALL be set to Stopped.
- The device SHALL respond with an OperationalCommandResponse command with an ErrorStateID of NoError.

1.13.6.3. Start Command

This command SHALL be supported if the device supports remotely starting the operation. If this command is supported, the 'Stop command SHALL also be supported.

On receipt of this command, the device SHALL start its operation if it is safe to do so and the device is in an operational state from which it can be started. There may be either regulatory or manufacturer-imposed safety and security requirements that first necessitate some specific action at the device before a Start command can be honored. In such instances, a device SHALL respond with a status code of CommandInvalidInState if a Start command is received prior to the required on-device action.

If this command is received when already in the Running state the device SHALL respond with an OperationalCommandResponse command with an ErrorStateID of NoError but take no further action.

A device that is unable to honor the Start command for whatever reason SHALL respond with an OperationalCommandResponse command with an ErrorStateID of UnableToStartOrResume but take no further action.

Otherwise, on success:

- The OperationalState attribute SHALL be set to Running.
- The device SHALL respond with an OperationalCommandResponse command with an ErrorStateID of NoError.

1.13.6.4. Resume Command

This command SHALL be supported if the device supports remotely resuming the operation. If this command is supported, the Pause command SHALL also be supported.

On receipt of this command, the device SHALL resume its operation from the point it was at when it received the Pause command, or from the point when it was paused by means outside of this cluster (for example by manual button press).

If this command is received when already in the Running state the device SHALL respond with an OperationalCommandResponse command with an ErrorStateID of NoError but take no further action.

A device that receives this command in any state other than Paused or Running SHALL respond with an OperationalCommandResponse command with an ErrorStateID of CommandInvalidInState but take no further action.

A device that is unable to honor the Resume command for any other reason SHALL respond with an OperationalCommandResponse command with an ErrorStateID of UnableToStartOrResume but take no further action.

Otherwise, on success:

- The OperationalState attribute SHALL be set to Running.
- The device SHALL respond with an OperationalCommandResponse command with an ErrorStateID of NoError.

1.13.6.5. OperationalCommandResponse Command

This command SHALL be supported by an implementation if any of the other commands defined by this cluster are supported (i.e. listed in the AcceptedCommandList global attribute). This command SHALL also be supported by an implementation of a derived cluster as a response to any commands that MAY be additionally defined therein.

This command SHALL be generated in response to any of the Start, Stop, Pause, or Resume commands. The data for this command SHALL be as follows:

ID	Name	Type	Constraint	Quality	Default	Conformance
0x00	**CommandResponseState**	ErrorStateStruct	all			M

1.13.6.5.1. CommandResponseState Field

This SHALL indicate the success or otherwise of the attempted command invocation. On a successful invocation of the attempted command, the ErrorStateID SHALL be populated with NoError. Please see the individual command sections for additional specific requirements on population.

1.13.7. Events

ID	Name	Priority	Access	Conformance
0x00	**OperationalError**	CRITICAL	V	M
0x01	**OperationCompletion**	INFO	V	O

1.13.7.1. OperationalError Event

This event is generated when a reportable error condition is detected. A device that generates this event SHALL also set the OperationalState attribute to Error, indicating an error condition.

This event SHALL contain the following fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	ErrorState	ErrorStateStruct	all			M

1.13.7.2. OperationCompletion Event

This event is generated when the overall operation ends, successfully or otherwise. For example, the completion of a cleaning operation in a Robot Vacuum Cleaner, or the completion of a wash cycle in a Washing Machine.

This event SHALL contain the following fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	CompletionErrorCode	enum8	all			M
1	TotalOperationalTime	elapsed-s	all	X		O
2	PausedTime	elapsed-s	all	X		O

1.13.7.2.1. CompletionErrorCode Field

This field provides an indication of the state at the end of the operation. This field SHALL have a value from the ErrorState set. A value of NoError indicates success, that is, no error has been detected.

1.13.7.2.2. TotalOperationalTime Field

The total operational time, in seconds, from when the operation was started via an initial Start command or manual action, until the operation completed. This includes any time spent while paused. There may be cases whereby the total operational time exceeds the maximum value that can be conveyed by this attribute, in such instances, this attribute SHALL be populated with null.

1.13.7.2.3. PausedTime Field

The total time spent in the paused state, in seconds. There may be cases whereby the total paused time exceeds the maximum value that can be conveyed by this attribute, in such instances, this attribute SHALL be populated with null.

1.14. Alarm Base Cluster

This cluster is a base cluster from which clusters for particular alarms for a device type can be derived. Each derivation SHALL define the values for the AlarmMap data type used in this cluster. Each derivation SHALL define which alarms are latched.

1.14.1. Revision History

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

Revision	Description
1	Initial revision

1.14.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	ALARM

1.14.3. Cluster ID

ID	Name
n/a	Alarm Base

1.14.4. Features

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

Bit	Code	Feature	Summary
0	**RESET**	Reset	Supports the ability to reset alarms

1.14.4.1. Reset Feature

This feature indicates that alarms can be reset via the Reset command.

1.14.5. Data Types

1.14.5.1. AlarmMap Type

This data type SHALL be a map32 with values defined by the derived cluster. The meaning of each bit position SHALL be consistent for all attributes in a derived cluster. That is, if bit 0 is defined for an alarm, the Latch, State, and Supported information for that alarm are also bit 0.

1.14.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**Mask**	AlarmMap	all		0	R V	M
0x0001	**Latch**	AlarmMap	all	F	0	R V	RESET
0x0002	**State**	AlarmMap	all		0	R V	M
0x0003	**Supported**	AlarmMap	all	F	0	R V	M

1.14.6.1. Mask Attribute

This attribute SHALL indicate a bitmap where each bit set in the Mask attribute corresponds to an alarm that SHALL be enabled.

1.14.6.2. Latch Attribute

This attribute SHALL indicate a bitmap where each bit set in the Latch attribute SHALL indicate that the corresponding alarm will be latched when set, and will not reset to inactive when the underlying condition which caused the alarm is no longer present, and so requires an explicit reset using the Reset command.

1.14.6.3. State Attribute

This attribute SHALL indicate a bitmap where each bit SHALL represent the state of an alarm. The value of true means the alarm is active, otherwise the alarm is inactive.

1.14.6.4. Supported Attribute

This attribute SHALL indicate a bitmap where each bit SHALL represent whether or not an alarm is supported. The value of true means the alarm is supported, otherwise the alarm is not supported.

If an alarm is not supported, the corresponding bit in Mask, Latch, and State SHALL be false.

1.14.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**Reset**	client ⇒ server	Y	O	RESET
0x01	**ModifyEnabledAlarms**	client ⇒ server	Y	O	O

1.14.7.1. Reset Command

This command resets active and latched alarms (if possible). Any generated Notify event SHALL contain fields that represent the state of the server after the command has been processed.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Alarms**	AlarmMap	all		0	M

1.14.7.1.1. Alarms Field

This field SHALL indicate a bitmap where each bit set in this field corresponds to an alarm that SHALL be reset to inactive in the State attribute unless the alarm definition requires manual intervention. If the alarms indicated are successfully reset, the response status code SHALL be SUCCESS, otherwise, the response status code SHALL be FAILURE.

1.14.7.2. ModifyEnabledAlarms Command

This command allows a client to request that an alarm be enabled or suppressed at the server.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Mask**	AlarmMap	all		0	M

1.14.7.2.1. Mask Field

This field SHALL indicate a bitmap where each bit set in the this field corresponds to an alarm that SHOULD be enabled or suppressed. A value of 1 SHALL indicate that the alarm SHOULD be enabled while a value of 0 SHALL indicate that the alarm SHOULD be suppressed.

A server that receives this command with a Mask that includes bits that are set for unknown alarms SHALL respond with a status code of INVALID_COMMAND.

A server that receives this command with a Mask that includes bits that are set for alarms which are not supported, as indicated in the Supported attribute, SHALL respond with a status code of INVALID_COMMAND.

A server that is unable to enable a currently suppressed alarm, or is unable to suppress a currently enabled alarm SHALL respond with a status code of FAILURE; otherwise the server SHALL respond with a status code of SUCCESS.

On a SUCCESS case, the server SHALL also change the value of the Mask attribute to the value of the Mask field from this command. After that the server SHALL also update the value of its State attribute to reflect the status of the new alarm set as indicated by the new value of the Mask attribute.

1.14.8. Events

ID	Name	Priority	Access	Conformance
0x00	**Notify**	INFO	V	M

1.14.8.1. Notify Event

This event SHALL be generated when one or more alarms change state, and SHALL have these fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
1	**Active**	AlarmMap	all		0	M
1	**Inactive**	AlarmMap	all		0	M
2	**State**	AlarmMap	all		0	M
3	**Mask**	AlarmMap	all		0	M

1.14.8.1.1. Active Field

This field SHALL indicate those alarms that have become active.

1.14.8.1.2. Inactive Field

This field SHALL indicate those alarms that have become inactive.

1.14.8.1.3. Mask Field

This field SHALL be a copy of the Mask attribute when this event was generated.

1.14.8.1.4. State Field

This field SHALL be a copy of the new State attribute value that resulted in the event being generated. That is, this field SHALL have all the bits in Active set and SHALL NOT have any of the bits in Inactive set.

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 6. 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
0x005C	Smoke and CO Alarm	An interface to smoke and CO alarms
various	Resource Monitoring	Attributes and commands for reporting conditions of various resources
0x005B	Air Quality Measurement	Attributes for reporting air quality classification
various	Concentration Measurement	Attributes and aliases for concentration measurements.

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 Cluster

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

2.2.1. 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; CCB 2048 2049 2050
2	CCB 2167
3	New data model format and notation

2.2.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	ILL

2.2.3. Cluster ID

ID	Name
0x0400	Illuminance Measurement

2.2.4. Data Types

2.2.4.1. LightSensorTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Photodiode**	Indicates photodiode sensor type	M
1	**CMOS**	Indicates CMOS sensor type	M
64 to 254	**MS**	Reserved for manufacturer specific light sensor types	O

2.2.5. 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
0x0004	**LightSensorType**	LightSensorType Enum	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 x $\log_{10}$(illuminance) + 1,

where 1 lx <= illuminance <= 3.576 Mlx, corresponding to a MeasuredValue in the range 1 to 0xFFFE.

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 LightSensorTypeEnum or null in case the sensor type is unknown.

2.3. Temperature Measurement Cluster

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	Scope	PICS Code
Base	Application	Endpoint	TMP

2.3.3. Cluster ID

ID	Name
0x0402	Temperature Measurement

2.3.4. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**MeasuredValue**	temperature	MinMeasuredValue to MaxMeasuredValue	XP		R V	M
0x0001	**MinMeasuredValue**	temperature	-27315 to MaxMeasured-Value-1	X		R V	M
0x0002	**MaxMeasuredValue**	temperature	MinMeasured-Value+1 to 32767	X		R V	M
0x0003	**Tolerance**	uint16	0 to 2048		0	R V	O

2.3.4.1. MeasuredValue Attribute

This attribute SHALL indicate the measured temperature.

The null value indicates that the temperature is unknown.

2.3.4.2. MinMeasuredValue Attribute

This attribute SHALL indicate 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

This 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.

2.4. Pressure Measurement Cluster

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	Scope	PICS Code
Base	Application	Endpoint	PRS

2.4.3. Cluster ID

ID	Name
0x0403	Pressure Measurement

2.4.4. Features

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

Bit	Code	Feature	Conformance	Summary
0	**EXT**	Extended	O	Extended range and resolution

2.4.5. Attributes

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

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0001	MinMeasuredValue	int16	-32767 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
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 SHALL represent the pressure in kPa as follows:

MeasuredValue = 10 x Pressure [kPa]

The null value indicates that the value is not available.

2.4.5.2. MinMeasuredValue Attribute

This attribute SHALL indicate 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 SHALL indicate 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

See Measured Value.

2.4.5.5. ScaledValue Attribute

This attribute SHALL represent the pressure in Pascals as follows:

ScaledValue = 10^{Scale} x Pressure [Pa]

The null value indicates that the value is not available.

2.4.5.6. MinScaledValue Attribute

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

The null value indicates that the value is not available.

2.4.5.8. ScaledTolerance Attribute

This attribute SHALL indicate the magnitude of the possible error that is associated with Scaled-Value. The true value is located in the range

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

2.4.5.9. Scale Attribute

This attribute SHALL indicate the base 10 exponent used to obtain ScaledValue (see ScaledValue).

2.5. Flow Measurement Cluster

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

Revision	Description
3	New data model format and notation

2.5.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	FLW

2.5.3. Cluster ID

ID	Name
0x0404	Flow Measurement

2.5.4. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**MeasuredValue**	uint16	MinMeasuredValue to MaxMeasuredValue	XP	null	R V	M
0x0001	**MinMeasuredValue**	uint16	0 to MaxMeasuredValue-1	X		R V	M
0x0002	**MaxMeasuredValue**	uint16	MinMeasuredValue+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:

MeasuredValue = 10 x 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.

2.6. Water Content Measurement Clusters

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 IDs

The table below is a list of Cluster IDs that conform to this specification.

ID	Name	Measurement Type
0x0405	Relative Humidity Measurement	Percentage of water in the air
0x0407	Leaf Wetness Measurement	Percentage of water in 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:

MeasuredValue = 100 x water content

Where 0% < = water content < = 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.

2.7. Occupancy Sensing Cluster

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

2.7.1. 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	Physical Contact Occupancy feature with mandatory OccupancySensorTypeBitmap
3	New data model format and notation

2.7.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	OCC

2.7.3. Cluster ID

ID	Name
0x0406	Occupancy Sensing

2.7.4. Data Types

2.7.4.1. OccupancyBitmap Type

This data type is derived from map8.

Bit	Name	Summary	Conformance
0	**Occupied**	Indicates the sensed occupancy state	M

2.7.4.1.1. Occupied Bit

If this bit is set, it SHALL indicate the occupied state else if the bit if not set, it SHALL indicate the unoccupied state.

2.7.4.2. OccupancySensorTypeBitmap Type

This data type is derived from map8.

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

2.7.4.3. OccupancySensorTypeEnum Type

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. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**Occupancy**	OccupancyBitmap	0 to 1	P		R V	M
0x0001	**OccupancySensorType**	OccupancySensorTypeEnum	desc		MS	R V	M
0x0002	**OccupancySensorTypeBitmap**	OccupancySensorTypeBitmap	0 to 7			R V	M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0010	**PIROccupiedToUnoccupiedDelay**	uint16	all		0	RW VM	O
0x0011	**PIRUnoccupiedToOccupiedDelay**	uint16	all		0	RW VM	PIRUnoccupiedToOccupiedThreshold, O
0x0012	**PIRUnoccupiedToOccupiedThreshold**	uint8	1 to 254		1	RW VM	PIRUnoccupiedToOccupiedDelay, O
0x0020	**UltrasonicOccupiedToUnoccupiedDelay**	uint16	all		0	RW VM	O
0x0021	**UltrasonicUnoccupiedToOccupiedDelay**	uint16	all		0	RW VM	UltrasonicUnoccupiedToOccupiedThreshold, O
0x0022	**UltrasonicUnoccupiedToOccupiedThreshold**	uint8	1 to 254		1	RW VM	UltrasonicUnoccupiedToOccupiedDelay, O
0x0030	**PhysicalContactOccupiedToUnoccupiedDelay**	uint16	all	X	0	RW VM	O
0x0031	**PhysicalContactUnoccupiedToOccupiedDelay**	uint16	all	X	0	RW VM	O

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0032	**PhysicalContactUnoccupiedToOccupiedThreshold**	uint8	1 to 254		1	RW VM	PhysicalContactUnoccupiedToOccupiedDelay, O

2.7.5.1. Occupancy Attribute

This attribute indicates the sensed (processed) status of occupancy.

2.7.5.2. OccupancySensorType Attribute

This attribute specifies the type of the occupancy sensor.

2.7.5.3. OccupancySensorTypeBitmap Attribute

This attribute specifies the types of the occupancy sensor. Each bit position, if set, indicates the corresponding sensing capability is implemented.

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

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

2.7.5.4. PIROccupiedToUnoccupiedDelay Attribute

This 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.

2.7.5.5. PIRUnoccupiedToOccupiedDelay Attribute

This 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.

2.7.5.6. PIRUnoccupiedToOccupiedThreshold Attribute

This 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.

2.7.5.7. UltrasonicOccupiedToUnoccupiedDelay Attribute

This attribute 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.

2.7.5.8. UltrasonicUnoccupiedToOccupiedDelay Attribute

This attribute 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.

2.7.5.9. UltrasonicUnoccupiedToOccupiedThreshold Attribute

This 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.

2.7.5.10. PhysicalContactOccupiedToUnoccupiedDelay Attribute

This 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.

2.7.5.11. PhysicalContactUnoccupiedToOccupiedDelay Attribute

This 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.

2.7.5.12. PhysicalContactUnoccupiedToOccupiedThreshold Attribute

This 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.

2.8. Resource Monitoring Clusters

This generic cluster provides an interface to the current condition of a resource. A resource is a component of a device that is designed to be replaced, refilled, or emptied when exhausted or full. Examples of resources include filters, cartridges, and water tanks. While batteries fit this definition they are not intended to be used with this cluster. Use the power source cluster for batteries instead.

NOTE	This cluster is not meant to be used for monitoring of the system resources, such as processing, memory utilization, networking properties, etc.

This cluster SHALL be used via an alias to a specific resource type (see Cluster IDs).

2.8.1. Revision History

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

Revision	Description
1	Initial version of the Resource Monitoring cluster

2.8.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	REPM

2.8.3. Cluster IDs

The table below is a list of aliased Cluster IDs which represent different resource types and conform to this cluster definition.

ID	Name	Resource Type	PICS Code
0x0071	HEPA Filter Monitoring	HEPA Filter	HEPAFREMON
0x0072	Activated Carbon Filter Monitoring	Activated Carbon Filter	ACFREMON

2.8.4. Features

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

Bit	Code	Feature	Conformance	Summary
0	**CON**	Condition	O	Supports monitoring the condition of the resource in percentage
1	**WRN**	Warning	O	Supports warning indication
2	**REP**	Replacement Product List	O	Supports specifying the list of replacement products

2.8.5. Data Types

2.8.5.1. DegradationDirectionEnum Type

This data type is derived from enum8.

Indicates the direction in which the condition of the resource changes over time.

Value	Name	Summary	Conformance
0	**Up**	The degradation of the resource is indicated by an upwards moving/increasing value	M
1	**Down**	The degradation of the resource is indicated by a downwards moving/decreasing value	M

2.8.5.2. ChangeIndicationEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**OK**	Resource is in good condition, no intervention required	M
1	**Warning**	Resource will be exhausted soon, intervention will shortly be required	WRN
2	**Critical**	Resource is exhausted, immediate intervention is required	M

2.8.5.3. ProductIdentifierTypeEnum Type

This data type is derived from enum8.

Indicate the type of identifier used to describe the product. Devices SHOULD use globally-recognized IDs over OEM specific ones.

Value	Name	Summary	Conformance
0	**UPC**	12-digit Universal Product Code	M
1	**GTIN-8**	8-digit Global Trade Item Number	M

Value	Name	Summary	Conformance
2	**EAN**	13-digit European Article Number	M
3	**GTIN-14**	14-digit Global Trade Item Number	M
4	**OEM**	Original Equipment Manufacturer part number	M

2.8.5.4. ReplacementProductStruct Type

Indicates the product identifier that can be used as a replacement for the resource.

ID	Name	Type	Constraint	Quality	Access	Default	Conformance
0	**ProductIdentifierType**	ProductIdentifierTypeEnum	desc		R		M
1	**ProductIdentifierValue**	string	max 20		R		M

2.8.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**Condition**	percent				R V	CON
0x0001	**DegradationDirection**	DegradationDirectionEnum	desc	F		R V	CON
0x0002	**ChangeIndication**	ChangeIndicationEnum			0	R V	M
0x0003	**InPlaceIndicator**	bool				R V	O
0x0004	**LastChangedTime**	epoch-s	all	X N	null	RW VO	O
0x0005	**ReplacementProductList**	list[ReplacementProductStruct]	max 5	F		R V	REP

2.8.6.1. Condition Attribute

This attribute SHALL indicate the current condition of the resource in percent.

2.8.6.2. DegradationDirection Attribute

This attribute SHALL indicate the direction of change for the condition of the resource over time, which helps to determine whether a higher or lower condition value is considered optimal.

2.8.6.3. ChangeIndication Attribute

This attribute SHALL be populated with a value from ChangeIndicationEnum that is indicative of the current requirement to change the resource.

2.8.6.4. InPlaceIndicator Attribute

This attribute SHALL indicate whether a resource is currently installed. A value of true SHALL indicate that a resource is installed. A value of false SHALL indicate that a resource is not installed.

2.8.6.5. LastChangedTime Attribute

This attribute MAY indicates the time at which the resource has been changed, if supported by the server. The attribute SHALL be null if it was never set or is unknown.

2.8.6.6. ReplacementProductList Attribute

This attribute SHALL indicate the list of supported products that may be used as replacements for the current resource. Each item in this list represents a unique ReplacementProductStruct.

2.8.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**ResetCondition**	client ⇒ server	Y	O	O

2.8.7.1. ResetCondition Command

Upon receipt, the device SHALL reset the Condition and ChangeIndicator attributes, indicating full resource availability and readiness for use, as initially configured. Invocation of this command MAY cause the LastChangedTime to be updated automatically based on the clock of the server, if the server supports setting the attribute.

2.9. Air Quality Cluster

This cluster provides an interface to air quality classification using distinct levels with human-readable labels.

2.9.1. Revision History

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

Revision	Description
1	Initial version of the Air Quality cluster

2.9.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	AIRQUAL

2.9.3. Cluster ID

ID	Name
0x005B	Air Quality

2.9.4. Features

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

Bit	Code	Feature	Conformance	Summary
0	**FAIR**	Fair	O	Cluster supports the Fair air quality level
1	**MOD**	Moderate	O	Cluster supports the Moderate air quality level
2	**VPOOR**	VeryPoor	O	Cluster supports the Very poor air quality level
3	**XPOOR**	ExtremelyPoor	O	Cluster supports the Extremely poor air quality level

2.9.5. Data Types

2.9.5.1. AirQualityEnum Type

This data type is derived from enum8.

The AirQualityEnum provides a representation of the quality of the analyzed air. It is up to the device manufacturer to determine the mapping between the measured values and their corre-

sponding enumeration values.

Value	Name	Summary	Conformance
0	**Unknown**	The air quality is unknown.	M
1	**Good**	The air quality is good.	M
2	**Fair**	The air quality is fair.	FAIR
3	**Moderate**	The air quality is moderate.	MOD
4	**Poor**	The air quality is poor.	M
5	**VeryPoor**	The air quality is very poor.	VPOOR
6	**ExtremelyPoor**	The air quality is extremely poor.	XPOOR

2.9.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	AirQuality	AirQualityEnum	desc		0	R V	M

2.9.6.1. AirQuality Attribute

This attribute SHALL indicate a value from AirQualityEnum that is indicative of the currently measured air quality.

2.10. Concentration Measurement Clusters

The server cluster provides an interface to concentration measurement functionality.

This cluster SHALL to be used via an alias to a specific substance (see Cluster IDs).

2.10.1. 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 2882

Revision	Description
3	Cluster redesigned to add support for Level Indication, Peak/Average Measurement, Medium/Unit of Measurement and Uncertainty.

2.10.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	CONC

2.10.3. Cluster IDs

The table below is a list of Cluster IDs that conform to this specification.

ID	Name	Substance Measured	PICS Code
0x040C	Carbon Monoxide Concentration Measurement	Carbon Monoxide (CO)	CMOCONC
0x040D	Carbon Dioxide Concentration Measurement	Carbon Dioxide (CO_2)	CDOCONC
0x0413	Nitrogen Dioxide Concentration Measurement	Nitrogen Dioxide (NO_2)	NDOCONC
0x0415	Ozone Concentration Measurement	Ozone (O_3)	OZCONC
0x042A	PM2.5 Concentration Measurement	PM2.5	PMICONC
0x042B	Formaldehyde Concentration Measurement	Formaldehyde (CH2O)	FLDCONC
0x042C	PM1 Concentration Measurement	PM1	PMHCONC
0x042D	PM10 Concentration Measurement	PM10	PMKCONC
0x042E	Total Volatile Organic Compounds Concentration Measurement	Total Volatile Organic Compounds (TVOC)	TVOCCONC
0x042F	Radon Concentration Measurement	Radon (Rn)	RNCONC

2.10.4. Features

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

Bit	Code	Feature	Conformance	Summary
0	**MEA**	NumericMeasurement	O.a+	Cluster supports numeric measurement of substance
1	**LEV**	LevelIndication	O.a+	Cluster supports basic level indication for substance using the ConcentrationLevel enum
2	**MED**	MediumLevel	[LEV]	Cluster supports the Medium Concentration Level
3	**CRI**	CriticalLevel	[LEV]	Cluster supports the Critical Concentration Level
4	**PEA**	PeakMeasurement	[MEA]	Cluster supports peak numeric measurement of substance
5	**AVG**	AverageMeasurement	[MEA]	Cluster supports average numeric measurement of substance

2.10.5. Data Types

2.10.5.1. MeasurementUnitEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**PPM**	Parts per Million (10^6)	MEA
1	**PPB**	Parts per Billion (10^9)	MEA
2	**PPT**	Parts per Trillion (10^{12})	MEA
3	**MGM3**	Milligram per m^3	MEA
4	**UGM3**	Microgram per m^3	MEA
5	**NGM3**	Nanogram per m^3	MEA
6	**PM3**	Particles per m^3	MEA

Value	Name	Summary	Conformance
7	**BQM3**	Becquerel per m^3	MEA

Where mentioned, Billion refers to 10^9, Trillion refers to 10^{12} (short scale).

2.10.5.2. MeasurementMediumEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Air**	The measurement is being made in Air	M
1	**Water**	The measurement is being made in Water	M
2	**Soil**	The measurement is being made in Soil	M

2.10.5.3. LevelValueEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Unknown**	The level is Unknown	M
1	**Low**	The level is considered Low	M
2	**Medium**	The level is considered Medium	MED
3	**High**	The level is considered High	M
4	**Critical**	The level is considered Critical	CRI

2.10.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**MeasuredValue**	single	MinMeasuredValue to MaxMeasuredValue	X P	null	R V	MEA

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0001	**MinMeasuredValue**	single	max MaxMeasuredValue	X	null	R V	MEA
0x0002	**MaxMeasuredValue**	single	min MinMeasuredValue	X	null	R V	MEA
0x0003	**PeakMeasuredValue**	single	MinMeasuredValue to MaxMeasuredValue	X P	null	R V	PEA
0x0004	**PeakMeasuredValueWindow**	elapsed-s	max 604800	P	1	R V	PEA
0x0005	**AverageMeasuredValue**	single	MinMeasuredValue to MaxMeasuredValue	X P	null	R V	AVG
0x0006	**AverageMeasuredValueWindow**	elapsed-s	max 604800	P	1	R V	AVG
0x0007	**Uncertainty**	single	MS		MS	R V	[MEA]
0x0008	**MeasurementUnit**	MeasurementUnitEnum		F	MS	R V	MEA
0x0009	**MeasurementMedium**	MeasurementMediumEnum		F	MS	R V	M
0x000A	**LevelValue**	LevelValueEnum			0	R V	LEV

2.10.6.1. MeasuredValue Attribute

This attribute SHALL represent the most recent measurement as a single-precision floating-point number. MeasuredValue's unit is represented by MeasurementUnit.

A value of null indicates that the measurement is unknown or outside the valid range.

MinMeasuredValue and MaxMeasuredValue define the valid range for MeasuredValue.

2.10.6.2. MinMeasuredValue Attribute

This attribute SHALL represent the minimum value of MeasuredValue that is capable of being measured. A MinMeasuredValue of null indicates that the MinMeasuredValue is not defined.

2.10.6.3. MaxMeasuredValue Attribute

This attribute SHALL represent the maximum value of MeasuredValue that is capable of being measured. A MaxMeasuredValue of null indicates that the MaxMeasuredValue is not defined.

2.10.6.4. PeakMeasuredValue Attribute

This attribute SHALL represent the maximum value of MeasuredValue that has been measured during the PeakMeasuredValueWindow. If this attribute is provided, the PeakMeasuredValueWindow attribute SHALL also be provided.

2.10.6.5. PeakMeasuredValueWindow Attribute

This attribute SHALL represent the window of time used for determining the PeakMeasuredValue. The value is in seconds.

2.10.6.6. AverageMeasuredValue Attribute

This attribute SHALL represent the average value of MeasuredValue that has been measured during the AverageMeasuredValueWindow. If this attribute is provided, the AverageMeasuredValueWindow attribute SHALL also be provided.

2.10.6.7. AverageMeasuredValueWindow Attribute

This attribute SHALL represent the window of time used for determining the AverageMeasuredValue. The value is in seconds.

2.10.6.8. Uncertainty Attribute

This attribute SHALL represent the range of error or deviation that can be found in MeasuredValue and PeakMeasuredValue. This is considered a +/- value and should be considered to be in MeasurementUnit.

2.10.6.9. MeasurementUnit Attribute

This attribute SHALL represent the unit of MeasuredValue. See MeasurementUnitEnum.

2.10.6.10. MeasurementMedium Attribute

This attribute SHALL represent the medium in which MeasuredValue is being measured. See MeasurementMediumEnum.

2.10.6.11. LevelValue Attribute

This attribute SHALL represent the level of the substance detected. See LevelValueEnum.

2.11. Smoke CO Alarm Cluster

This cluster provides an interface for observing and managing the state of smoke and CO alarms.

2.11.1. Revision History

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

Revision	Description
1	Initial Release

2.11.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	SMOKECO

2.11.3. Cluster ID

ID	Name
0x005C	Smoke CO Alarm

2.11.4. Features

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

Bit	Code	Feature	Conformance	Summary
0	**SMOKE**	SmokeAlarm	O.a+	Supports Smoke alarm
1	**CO**	COAlarm	O.a+	Supports CO alarm

2.11.5. Data Types

2.11.5.1. AlarmStateEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Normal**	Nominal state, the device is not alarming	M
1	**Warning**	Warning state	O
2	**Critical**	Critical state	M

2.11.5.1.1. Normal Value

This value SHALL indicate that this alarm is not alarming.

2.11.5.1.2. Warning Value

This value SHALL indicate that this alarm is in a warning state. Alarms in this state SHOULD be subject to being muted via physical interaction.

2.11.5.1.3. Critical Value

This value SHALL indicate that this alarm is in a critical state. Alarms in this state SHALL NOT be subject to being muted via physical interaction.

2.11.5.2. SensitivityEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**High**	High sensitivity	O
1	**Standard**	Standard Sensitivity	M
2	**Low**	Low sensitivity	O

2.11.5.3. ExpressedStateEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Normal**	Nominal state, the device is not alarming	M
1	**SmokeAlarm**	Smoke Alarm state	SMOKE
2	**COAlarm**	CO Alarm state	CO
3	**BatteryAlert**	Battery Alert State	M
4	**Testing**	Test in Progress	M
5	**HardwareFault**	Hardware Fault Alert State	M
6	**EndOfService**	End of Service Alert State	M
7	**InterconnectSmoke**	Interconnected Smoke Alarm State	O
8	**InterconnectCO**	Interconnected CO Alarm State	O

2.11.5.3.1. Normal Value

This value SHALL indicate that this alarm is not alarming.

2.11.5.3.2. SmokeAlarm Value

This value SHALL indicate that this alarm is currently expressing visual indication of Smoke Alarm. This value SHALL indicate that the alarm is currently expressing audible indication of Smoke Alarm unless the DeviceMuted attribute is supported and set to Muted.

2.11.5.3.3. COAlarm Value

This value SHALL indicate that this alarm is currently expressing visual indication of CO Alarm. This value SHALL indicate that the alarm is currently expressing audible indication of CO Alarm unless the DeviceMuted attribute is supported and set to Muted.

2.11.5.3.4. BatteryAlert Value

This value SHALL indicate that this alarm is currently expressing visual indication of Critical Low Battery. This value SHALL indicate that the alarm is currently expressing audible indication of Critical Low Battery unless the DeviceMuted attribute is supported and set to Muted.

2.11.5.3.5. Testing Value

This value SHALL indicate that this alarm is currently expressing visual and audible indication of SelfTest.

2.11.5.3.6. HardwareFault Value

This value SHALL indicate that this alarm is currently expressing visual indication of Hardware Fault. This value SHALL indicate that the alarm is currently expressing audible indication of Hardware Fault unless the DeviceMuted attribute is supported and set to Muted.

2.11.5.3.7. EndOfService Value

This value SHALL indicate that this alarm is currently expressing visual indication of End Of Service. This value SHALL indicate that the alarm is currently expressing audible indication of End of Service unless the DeviceMuted attribute is supported and set to Muted.

2.11.5.3.8. InterconnectSmoke Value

This value SHALL indicate that this alarm is currently expressing visual indication of Smoke Alarm caused by Interconnect. This value SHALL indicate that the alarm is currently expressing audible indication of Smoke Alarm caused by Interconnect unless the DeviceMuted attribute is supported and set to Muted.

2.11.5.3.9. InterconnectCO Value

This value SHALL indicate that this alarm is currently expressing visual indication of CO Alarm caused by Interconnect. This value SHALL indicate that the alarm is currently expressing audible indication of CO Alarm caused by Interconnect unless the DeviceMuted attribute is supported and set to Muted.

2.11.5.4. MuteStateEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**NotMuted**	Not Muted	M
1	**Muted**	Muted	M

2.11.5.4.1. NotMuted Value

This value SHALL indicate that the device is not muted.

2.11.5.4.2. Muted Value

This value SHALL indicate that the device is muted.

2.11.5.5. EndOfServiceEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Normal**	Device has not expired	M
1	**Expired**	Device has reached its end of service	M

2.11.5.5.1. Expired Value

This value SHALL indicate that the device has reached its end of service, and needs to be replaced.

2.11.5.5.2. Normal Value

This value SHALL indicate that the device has not yet reached its end of service, and does not need to be imminently replaced.

2.11.5.6. ContaminationStateEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Normal**	Nominal state, the sensor is not contaminated	M
1	**Low**	Low contamination	O
2	**Warning**	Warning state	O
3	**Critical**	Critical state, will cause nuisance alarms	M

2.11.5.6.1. Normal Value

This value SHALL indicate that the smoke sensor has nominal contamination levels, no customer action is required.

2.11.5.6.2. Low Value

This value SHALL indicate that the smoke sensor has detectable contamination levels, but the contamination is too low to cause a visible or audible alarm.

2.11.5.6.3. Warning Value

This value SHALL indicate that the smoke sensor has contamination levels in a warning state. At this level, the contamination may cause a visible or audible alarm. User intervention is suggested.

2.11.5.6.4. Critical Value

This value SHALL indicate that the smoke sensor has contamination levels in a critical state. At this level, the contamination should cause a visible or audible alarm. User intervention is required. Critical contamination of the sensor SHALL also be reflected as a HardwareFault.

2.11.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**ExpressedState**	ExpressedStateEnum	all	N		R V	M
0x0001	**SmokeState**	AlarmStateEnum	all	N		R V	SMOKE
0x0002	**COState**	AlarmStateEnum	all	N		R V	CO
0x0003	**BatteryAlert**	AlarmStateEnum	all	N		R V	M
0x0004	**DeviceMuted**	MuteStateEnum	all	N		R V	O
0x0005	**TestInProgress**	bool	all			R V	M
0x0006	**HardwareFaultAlert**	bool	all	N		R V	M
0x0007	**EndOfServiceAlert**	EndOfServiceEnum	all	N		R V	M
0x0008	**InterconnectSmokeAlarm**	AlarmStateEnum	all			R V	O

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0009	**InterconnectCOAlarm**	AlarmStateEnum	all			R V	O
0x000A	**ContaminationState**	ContaminationStateEnum	all			R V	[SMOKE]
0x000B	**SmokeSensitivityLevel**	SensitivityEnum	all			RW VM	[SMOKE]
0x000C	**ExpiryDate**	epoch-s	all	F		R V	O

2.11.6.1. ExpressedState Attribute

This attribute SHALL indicate the visibly- and audibly-expressed state of the alarm. When multiple alarm conditions are being reflected in the server, this attribute SHALL indicate the condition with the highest priority. Priority order of conditions is determined by the manufacturer and SHALL be supplied as a part of certification procedure. If the value of ExpressedState is not Normal, the attribute corresponding to the value SHALL NOT be Normal. For example, if the ExpressedState is set to SmokeAlarm, the value of the SmokeState will indicate the severity of the alarm (Warning or Critical). Clients SHOULD also read the other attributes to be aware of further alarm conditions beyond the one indicated in ExpressedState.

Visible expression is typically a LED light pattern. Audible expression is a horn or speaker pattern. Audible expression SHALL BE suppressed if the DeviceMuted attribute is supported and set to Muted.

2.11.6.2. SmokeState Attribute

This attribute SHALL indicate whether the device's smoke sensor is currently triggering a smoke alarm.

2.11.6.3. COState Attribute

This attribute SHALL indicate whether the device's CO sensor is currently triggering a CO alarm.

2.11.6.4. BatteryAlert Attribute

This attribute SHALL indicate whether the power resource fault detection mechanism is currently triggered at the device. If the detection mechanism is triggered, this attribute SHALL be set to Warning or Critical, otherwise it SHALL be set to Normal. The battery state SHALL also be reflected in the Power Source cluster representing the device's battery using the appropriate supported attributes and events.

2.11.6.5. DeviceMuted Attribute

This attribute SHALL indicate the whether the audible expression of the device is currently muted. Audible expression is typically a horn or speaker pattern.

2.11.6.6. TestInProgress Attribute

This attribute SHALL indicate whether the device self-test is currently activated. If the device self-test is activated, this attribute SHALL be set to True, otherwise it SHALL be set to False.

2.11.6.7. HardwareFaultAlert Attribute

This attribute SHALL indicate whether the hardware fault detection mechanism is currently triggered. If the detection mechanism is triggered, this attribute SHALL be set to True, otherwise it SHALL be set to False.

2.11.6.8. EndOfServiceAlert Attribute

This attribute SHALL indicate whether the end-of-service has been triggered at the device. This attribute SHALL be set to Expired when the device reaches the end-of-service.

2.11.6.9. InterconnectSmokeAlarm Attribute

This attribute SHALL indicate whether the interconnected smoke alarm is currently triggering by branching devices. When the interconnected smoke alarm is being triggered, this attribute SHALL be set to Warning or Critical, otherwise it SHALL be set to Normal.

2.11.6.10. InterconnectCOAlarm Attribute

This attribute SHALL indicate whether the interconnected CO alarm is currently triggering by branching devices. When the interconnected CO alarm is being triggered, this attribute SHALL be set to Warning or Critical, otherwise it SHALL be set to Normal.

2.11.6.11. ContaminationState Attribute

This attribute SHALL indicate the contamination level of the smoke sensor.

2.11.6.12. SmokeSensitivityLevel Attribute

This attribute SHALL indicate the sensitivity level of the smoke sensor configured on the device.

2.11.6.13. ExpiryDate Attribute

This attribute SHALL indicate the date when the device reaches its stated expiry date. After the ExpiryDate has been reached, the EndOfServiceAlert SHALL start to be triggered. To account for better customer experience across time zones, the EndOfServiceAlert MAY be delayed by up to 24 hours after the ExpiryDate. Similarly, clients MAY delay any actions based on the ExpiryDate by up to 24 hours to best align with the local time zone.

2.11.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**SelfTestRequest**	client ⇒ server	Y	O	O

2.11.7.1. SelfTestRequest Command

This command SHALL initiate a device self-test. The return status SHALL indicate whether the test was successfully initiated. Only one SelfTestRequest may be processed at a time. When the value of the ExpressedState attribute is any of SmokeAlarm, COAlarm, Testing, InterconnectSmoke, InterconnectCO, the device SHALL NOT execute the self-test, and SHALL return status code BUSY.

Upon successful acceptance of SelfTestRequest, the TestInProgress attribute SHALL be set to True and ExpressedState attribute SHALL be set to Testing. Any faults identified during the test SHALL be reflected in the appropriate attributes and events. Upon completion of the self test procedure, the SelfTestComplete event SHALL be generated, the TestInProgress attribute SHALL be set to False and ExpressedState attribute SHALL be updated to reflect the current state of the server.

2.11.8. Events

ID	Name	Priority	Access	Conformance
0x00	**SmokeAlarm**	CRITICAL	V	SMOKE
0x01	**COAlarm**	CRITICAL	V	CO
0x02	**LowBattery**	INFO	V	M
0x03	**HardwareFault**	INFO	V	M
0x04	**EndOfService**	INFO	V	M
0x05	**SelfTestComplete**	INFO	V	M
0x06	**AlarmMuted**	INFO	V	O
0x07	**MuteEnded**	INFO	V	O
0x08	**InterconnectSmokeAlarm**	CRITICAL	V	[SMOKE]
0x09	**InterconnectCOAlarm**	CRITICAL	V	[CO]
0x0A	**AllClear**	INFO	V	M

2.11.8.1. SmokeAlarm Event

This event SHALL be generated when SmokeState attribute changes to either Warning or Critical state.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**AlarmSeverityLevel**	AlarmStateEnum	all			M

2.11.8.1.1. AlarmSeverityLevel Field

This field SHALL indicate the current value of the SmokeState attribute.

2.11.8.2. COAlarm Event

This event SHALL be generated when COState attribute changes to either Warning or Critical state.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**AlarmSeverityLevel**	AlarmStateEnum	all			M

2.11.8.2.1. AlarmSeverityLevel Field

This field SHALL indicate the current value of the COState attribute.

2.11.8.3. LowBattery Event

This event SHALL be generated when BatteryAlert attribute changes to either Warning or Critical state.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**AlarmSeverityLevel**	AlarmStateEnum	all			M

2.11.8.3.1. AlarmSeverityLevel Field

This field SHALL indicate the current value of the BatteryAlert attribute.

2.11.8.4. HardwareFault Event

This event SHALL be generated when the device detects a hardware fault that leads to setting HardwareFaultAlert to True.

2.11.8.5. EndOfService Event

This event SHALL be generated when the EndOfServiceAlert is set to Expired.

2.11.8.6. SelfTestComplete Event

This event SHALL be generated when the SelfTest completes, and the attribute TestInProgress changes to False.

2.11.8.7. AlarmMuted Event

This event SHALL be generated when the DeviceMuted attribute changes to Muted.

2.11.8.8. MuteEnded Event

This event SHALL be generated when DeviceMuted attribute changes to NotMuted.

2.11.8.9. InterconnectSmokeAlarm Event

This event SHALL be generated when the device hosting the server receives a smoke alarm from an interconnected sensor.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**AlarmSeverityLevel**	AlarmStateEnum	all			M

2.11.8.9.1. AlarmSeverityLevel Field

This field SHALL indicate the current value of the InterconnectSmokeAlarm attribute.

2.11.8.10. InterconnectCOAlarm Event

This event SHALL be generated when the device hosting the server receives a CO alarm from an interconnected sensor.

The data of this event SHALL contain the following information:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**AlarmSeverityLevel**	AlarmStateEnum	all			M

2.11.8.10.1. AlarmSeverityLevel Field

This field SHALL indicate the current value of the InterconnectCOAlarm attribute.

2.11.8.11. AllClear Event

This event SHALL be generated when ExpressedState attribute returns to Normal state.

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 7. Overview of the Lighting Clusters

Cluster 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
6	Added clarifications to Scenes support for Matter

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.

Bit	Code	Feature	Description
3	**XY**	XY	Supports color specification via XY.
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.

3.2.6.2. Independent transition in hue and saturation

Various commands in this cluster can be used to start transitions in hue and/or saturation.

- When a transition in hue is in progress, and a command to change saturation (MoveSaturation (with MoveMode!=Stop), StepSaturation, MoveToSaturation) is received by the server, this latter command SHALL NOT interrupt the ongoing transition in hue.
- When a transition in saturation is in progress, and a command to change hue (MoveHue (with MoveMode!=Stop), EnhancedMoveHue (with MoveMode!=Stop) StepHue, EnhancedStepHue, MoveToHue, EnhancedMoveToHue) is received by the server, this latter command SHALL NOT interrupt the ongoing transition in saturation.

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 8. Attributes of the Color Information Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	CurrentHue	uint8	0 to 254	PN	0	R V	HS
0x0001	CurrentSaturation	uint8	0 to 254	PSN	0	R V	HS
0x0002	RemainingTime	uint16	0 to 65534		0	R V	O
0x0003	CurrentX	uint16	0 to 0xFEFF	PSN	0x616B (0.381)	R V	XY
0x0004	CurrentY	uint16	0 to 0xFEFF	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	ColorTemperatureMireds	uint16	0 to 0xFEFF	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	SN	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	ColorLoopStartEnhancedHue	uint16	all		0x2300	R V	CL
0x4006	ColorLoopStoredEnhancedHue	uint16	all		0	R V	CL
0x400A	ColorCapabilities	map16	0 to 0x001F		0	R V	M
0x400B	ColorTempPhysicalMinMireds	uint16	0 to 0xFEFF		0	R V	CT
0x400C	ColorTempPhysicalMaxMireds	uint16	0 to 0xFEFF		0xFEFF	R V	CT

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x400D	CoupleColorTempToLevelMinMireds	uint16	ColorTempPhysicalMinMireds to ColorTemperatureMireds		MS	R V	CT | ColorTemperatureMireds
0x4010	StartUpColorTemperatureMireds	uint16	0 to 0xFEFF	NX	MS	RW VM	CT | ColorTemperatureMireds

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.

3.2.7.1. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following attributes SHALL be part of the ExtensionFieldSetStruct of the Scene Table. If an attribute is not implemented, the value that will be used for it in the AttributeValuePairStruct is given in parentheses. If the implicit form of the ExtensionFieldSetStruct is used, the order of the attributes in the AttributeValueList is in the given order, i.e., the attribute listed as 1 is added first:

1. CurrentX (0)
2. CurrentY (0)
3. EnhancedCurrentHue (null)
4. CurrentSaturation (null)
5. ColorLoopActive (0)
6. ColorLoopDirection (0)
7. ColorLoopTime (0)
8. ColorTemperatureMireds (null)
9. EnhancedColorMode

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.

If the Scenes cluster server is implemented on the same endpoint, and the cluster revision is 6 or

above, then all extension fields in the list above, including up to EnhancedColorMode (item 9), SHALL be present in the extension fields set for a Scene to be considered valid. This disambiguates the color mode used within the Scene.

3.2.7.2. 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:
Hue = CurrentHue x 360 / 254 (CurrentHue in the range 0 to 254 inclusive)

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

3.2.7.3. 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 = 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.

3.2.7.4. RemainingTime Attribute

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

3.2.7.5. 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 = CurrentX / 65536 (CurrentX in the range 0 to 65279 inclusive)

3.2.7.6. 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 = CurrentY / 65536 (CurrentY in the range 0 to 65279 inclusive)

3.2.7.7. 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 9. 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

3.2.7.8. 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.

3.2.7.9. 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 / 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.

3.2.7.10. 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 10. Values of the ColorMode Attribute

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

Value	Attributes that Determine the Color
2	ColorTemperatureMireds

3.2.7.11. 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 11. 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.

3.2.7.12. 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.

3.2.7.13. 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 12. 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.

3.2.7.14. 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.

3.2.7.15. 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.

3.2.7.16. 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 0xFFFE).

3.2.7.17. ColorLoopStartEnhancedHue Attribute

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

3.2.7.18. 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.

3.2.7.19. 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.

3.2.7.20. 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. ColorTempPhysicalMinMireds <= ColorTemperatureMireds.

3.2.7.21. 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. ColorTemperatureMireds <= ColorTempPhysicalMaxMireds.

3.2.7.22. 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:
ColorTempPhysicalMinMireds ≤ CoupleColorTempToLevelMinMireds ≤ ColorTemperatureMireds

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

3.2.7.23. 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 13. Values of the StartUpColorTemperatureMireds attribute

Value	Action on power up
0 to 0xFEFF	Set the ColorTemperatureMireds attribute to this value.
null	Set the ColorTemperatureMireds 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 14. Defined Primaries Information Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0010	NumberOfPrimaries	uint8	0 to 6	FX	-	R V	M
0x0011	Primary1X	uint16	0 to 0xFEFF	F	-	R V	M^0
0x0012	Primary1Y	uint16	0 to 0xFEFF	F	-	R V	M^0
0x0013	Primary1Intensity	uint8	all	FX	-	R V	M^0
0x0015	Primary2X	uint16	0 to 0xFEFF	F	-	R V	M^1
0x0016	Primary2Y	uint16	0 to 0xFEFF	F	-	R V	M^1
0x0017	Primary2Intensity	uint8	all	FX	-	R V	M^1
0x0019	Primary3X	uint16	0 to 0xFEFF	F	-	R V	M^2
0x001A	Primary3Y	uint16	0 to 0xFEFF	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 = Primary1X / 65536 (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 = Primary1Y / 65536 (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 15. Additional Defined Primaries Information Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
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

M^i = 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 16. Defined Color Points Settings Attribute Set

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
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
0x0036	ColorPointGX	uint16	0 to 0xFEFF		-	RW VM	O
0x0037	ColorPointGY	uint16	0 to 0xFEFF		-	RW VM	O
0x0038	ColorPointGIntensity	uint8	all	X	-	RW VM	O
0x003A	ColorPointBX	uint16	0 to 0xFEFF		-	RW VM	O
0x003B	ColorPointBY	uint16	0 to 0xFEFF		-	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 = WhitePointX / 65536 (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 = WhitePointY / 65536 (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 = ColorPointRX / 65536 (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 = ColorPointRY / 65536 (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 17. 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
0x0A	MoveToColorTemperature	client ⇒ server	Y	O	CT
0x40	EnhancedMoveToHue	client ⇒ server	Y	O	EHUE
0x41	EnhancedMoveHue	client ⇒ server	Y	O	EHUE
0x42	EnhancedStepHue	client ⇒ server	Y	O	EHUE
0x43	EnhancedMoveToHueAndSaturation	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 which has a 'stop' semantic such as the EnhancedMoveToHue command with MoveMode==Stop, or the StopMoveStep 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 18. 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

ID	Name	Type	Constraint	Quality	Default	Conformance
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 19. 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 20. 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). This SHALL stop any ongoing hue and/or saturation transition(s).
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.

MoveMode	Action on Receipt
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	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 21. 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 22. 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
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 SHALL 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

ID	Name	Type	Constraint	Quality	Default	Conformance
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 23. 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 24. 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). This SHALL stop any ongoing hue and/or saturation transition(s).
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 25. Values of the StepMode Field

Value	Description
0	Reserved
1	Up
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 26. 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 color space, i.e., movement is 'in a straight line' across the CIE xyY Color Space.

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 0xFEFF			M
1	ColorY	uint16	0 to 0xFEFF			M

ID	Name	Type	Constraint	Quality	Default	Conformance
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
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 0xFEFF			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	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 EnhancedColorMode 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

ID	Name	Type	Constraint	Quality	Default	Conformance
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 EnhancedColorMode 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 27. 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). This SHALL stop any ongoing hue and/or saturation transition(s).
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	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 28. 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.

StepMode	Action on Receipt
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 color space, i.e., movement is 'in a straight line' across the CIE xyY Color Space.

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 29. Format of the UpdateFlags Field of the ColorLoopSet Command

Bit	Name
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 30. 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 31. 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 0xFEFF			M
3	ColorTemperatureMaximumMireds	uint16	0 to 0xFEFF			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 (≡ an upper bound on the color temperature in kelvins) for the current move operation such that:

ColorTempPhysicalMinMireds <= ColorTemperatureMinimumMireds field <= 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 (≡ a lower bound on the color temperature in kelvins) for the current move operation such that:

ColorTemperatureMireds <= ColorTemperatureMaximumMireds field <= 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 32. 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 0xFEFF			M
4	ColorTemperatureMaximumMireds	uint16	0 to 0xFEFF			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 (≡ an upper bound on the color temperature in kelvins) for the current step operation such that:

ColorTempPhysicalMinMireds <= ColorTemperatureMinimumMireds field <= 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 (≡ a lower bound on the color temperature in kelvins) for the current step operation such that:

ColorTemperatureMireds ≤ ColorTemperatureMaximumMireds field ≤ 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 33. Actions on Receipt of the StepColorTemperature Command

StepMode	Action on Receipt
Up	Increase the ColorTemperatureMireds attribute (≡ 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 (≡ 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

This cluster is used for configuring a lighting ballast.

NOTE Support for Ballast Configuration cluster is provisional.

3.3.1. 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 2104 2193 2230 2393 Deprecated some attributes
3	CCB 2881
4	New data model format and notation

3.3.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	BC

3.3.3. Cluster ID

ID	Name
0x0301	Ballast Configuration

3.3.4. 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.

3.3.5. Data Types

3.3.5.1. BallastStatusBitmap Type

This data type is derived from map8.

Bit	Name	Summary
0	**BallastNonOperational**	Operational state of the ballast.
1	**LampFailure**	Operational state of the lamps.

3.3.5.1.1. BallastNonOperational Bit

This bit SHALL indicate whether the ballast is operational.

- 0 = The ballast is fully operational
- 1 = The ballast is not fully operational

3.3.5.1.2. LampFailure Bit

This bit SHALL indicate whether all lamps is operational.

- 0 = All lamps are operational

- 1 = One or more lamp is not in its socket or is faulty

3.3.5.2. LampAlarmModeBitmap Type

This data type is derived from map8.

Bit	Name	Summary
0	**LampBurnHours**	State of LampBurnHours alarm generation

3.3.5.2.1. LampBurnHours Bit

This bit SHALL indicate that the LampBurnHours attribute MAY generate an alarm.

3.3.6. Attributes

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	BallastStatusBitmap	all		0	R V	O
0x0010	MinLevel	uint8	PhysicalMinLevel to MaxLevel		PhysicalMinLevel	RW VM	M
0x0011	MaxLevel	uint8	MinLevel to PhysicalMaxLevel		PhysicalMaxLevel	RW VM	M
0x0012	PowerOnLevel						D
0x0013	PowerOnFadeTime						D
0x0014	IntrinsicBallastFactor	uint8	all	X		RW VM	O
0x0015	BallastFactorAdjustment	uint8	100 to MS	X	null	RW VM	O
0x0020	LampQuantity	uint8	all			R V	M

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
0x0034	LampAlarmMode	LampAlarmModeBitmap	all		0	RW VM	O
0x0035	LampBurnHoursTripPoint	uint24	all	X	null	RW VM	O

3.3.6.1. PhysicalMinLevel Attribute

This attribute SHALL specify the minimum light output the ballast can achieve according to the dimming light curve (see Dimming Curve).

3.3.6.2. PhysicalMaxLevel Attribute

This attribute SHALL specify the maximum light output the ballast can achieve according to the dimming light curve (see Dimming Curve).

3.3.6.3. BallastStatus Attribute

This attribute SHALL specify the status of various aspects of the ballast or the connected lights, see BallastStatusBitmap.

3.3.6.4. MinLevel Attribute

This attribute SHALL specify the light output of the ballast according to the dimming light curve (see Dimming 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.

3.3.6.5. MaxLevel Attribute

This attribute SHALL specify the light output of the ballast according to the dimming light curve (see Dimming 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.

3.3.6.6. IntrinsicBallastFactor Attribute

This attribute SHALL specify the ballast factor, as a percentage, of the ballast/lamp combination, prior to any adjustment.

A value of null indicates in invalid value.

3.3.6.7. BallastFactorAdjustment Attribute

This attribute SHALL specify the multiplication factor, as a percentage, to be applied to the configured light output of the lamps. A typical use for this attribute is to compensate for reduction in efficiency over the lifetime of a lamp.

The light output is given by

actual light output = configured light output x 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 changed. The value of null indicates that ballast factor scaling is not in use.

3.3.6.8. LampQuantity Attribute

This attribute SHALL specify 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).

3.3.6.9. LampType Attribute

This attribute SHALL specify the type of lamps (including their wattage) connected to the ballast.

3.3.6.10. LampManufacturer Attribute

This attribute SHALL specify the name of the manufacturer of the currently connected lamps.

3.3.6.11. LampRatedHours Attribute

This attribute SHALL specify the number of hours of use the lamps are rated for by the manufacturer.

A value of null indicates an invalid or unknown time.

3.3.6.12. LampBurnHours Attribute

This attribute SHALL specify 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 lamps 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.

3.3.6.13. LampAlarmMode Attribute

This attribute SHALL specify which attributes MAY cause an alarm notification to be generated. A 1 in each bit position means that its associated attribute is able to generate an alarm. (**Note:** All alarms are also logged in the alarm table – see Alarms cluster).

3.3.6.14. LampBurnHoursTripPoint Attribute

This attribute SHALL specify 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 has the value of null, then this alarm SHALL NOT be generated.

3.3.7. 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 Min-

Level, MaxLevel and CurrentLevel.

Table 34. 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%
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

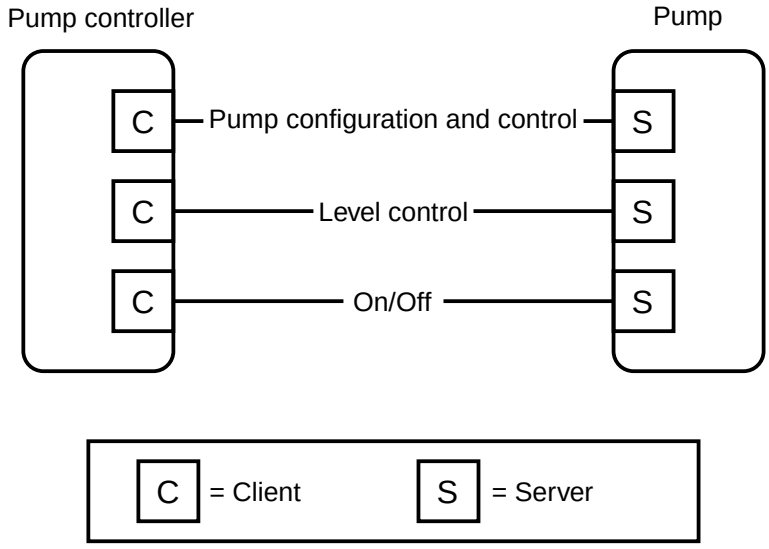
Precooling: Cooling a building in the early (cooler) part of the day, so that the thermal mass of the building decreases cooling needs in the later (hotter) part of the day.

4.1.3. Cluster List

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

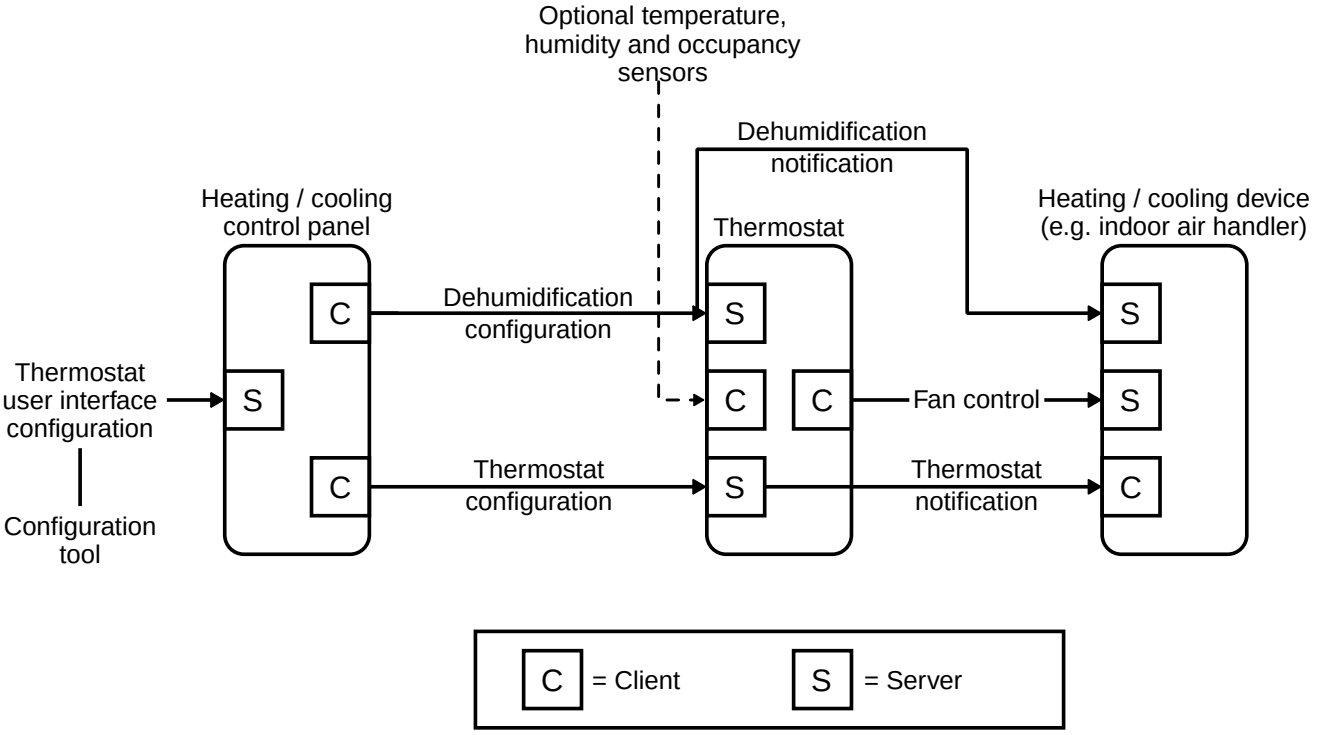
Table 35. Overview of the HVAC Clusters

Cluster 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 Type

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 Type

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 Type

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	**MinConstPressure**	int16	all	X F	null	R V	PRSCONST, [AUTO]
0x0004	**MaxConstPressure**	int16	all	X F	null	R V	PRSCONST, [AUTO]
0x0005	**MinCompPressure**	int16	all	X F	null	R V	PRSCOMP, [AUTO]
0x0006	**MaxCompPressure**	int16	all	X F	null	R V	PRSCOMP, [AUTO]
0x0007	**MinConstSpeed**	uint16	all	X F	null	R V	SPD, [AUTO]
0x0008	**MaxConstSpeed**	uint16	all	X F	null	R V	SPD, [AUTO]
0x0009	**MinConstFlow**	uint16	all	X F	null	R V	FLW, [AUTO]
0x000A	**MaxConstFlow**	uint16	all	X F	null	R V	FLW, [AUTO]
0x000B	**MinConstTemp**	int16	-27315 to max	X F	null	R V	TEMP, [AUTO]
0x000C	**MaxConstTemp**	int16	-27315 to max	X F	null	R V	TEMP, [AUTO]
0x0010	**PumpStatus**	PumpStatusBitmap	desc	P	0	R V	O
0x0011	**EffectiveOperationMode**	OperationModeEnum	desc	N	desc	R V	M
0x0012	**EffectiveControlMode**	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	**LifetimeRunningHours**	uint24	all	X N	0	RW VM	O
0x0016	**Power**	uint24	all	X	null	R V	O
0x0017	**LifetimeEnergyConsumed**	uint32	all	X N	0	RW VM	O
0x0020	**OperationMode**	OperationModeEnum	desc	N	0	RW VM	M
0x0021	**ControlMode**	ControlModeEnum	desc	N	0	RW VM	O
0x0022	**AlarmMask**	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 m^3/h to 6,553.4 m^3/h (steps of 0.1 m^3/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 m^3/h to 6,553.4 m^3/h (steps of 0.1 m^3/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 m^3/h to 6,553.4 m^3/h (steps of 0.1 m^3/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.

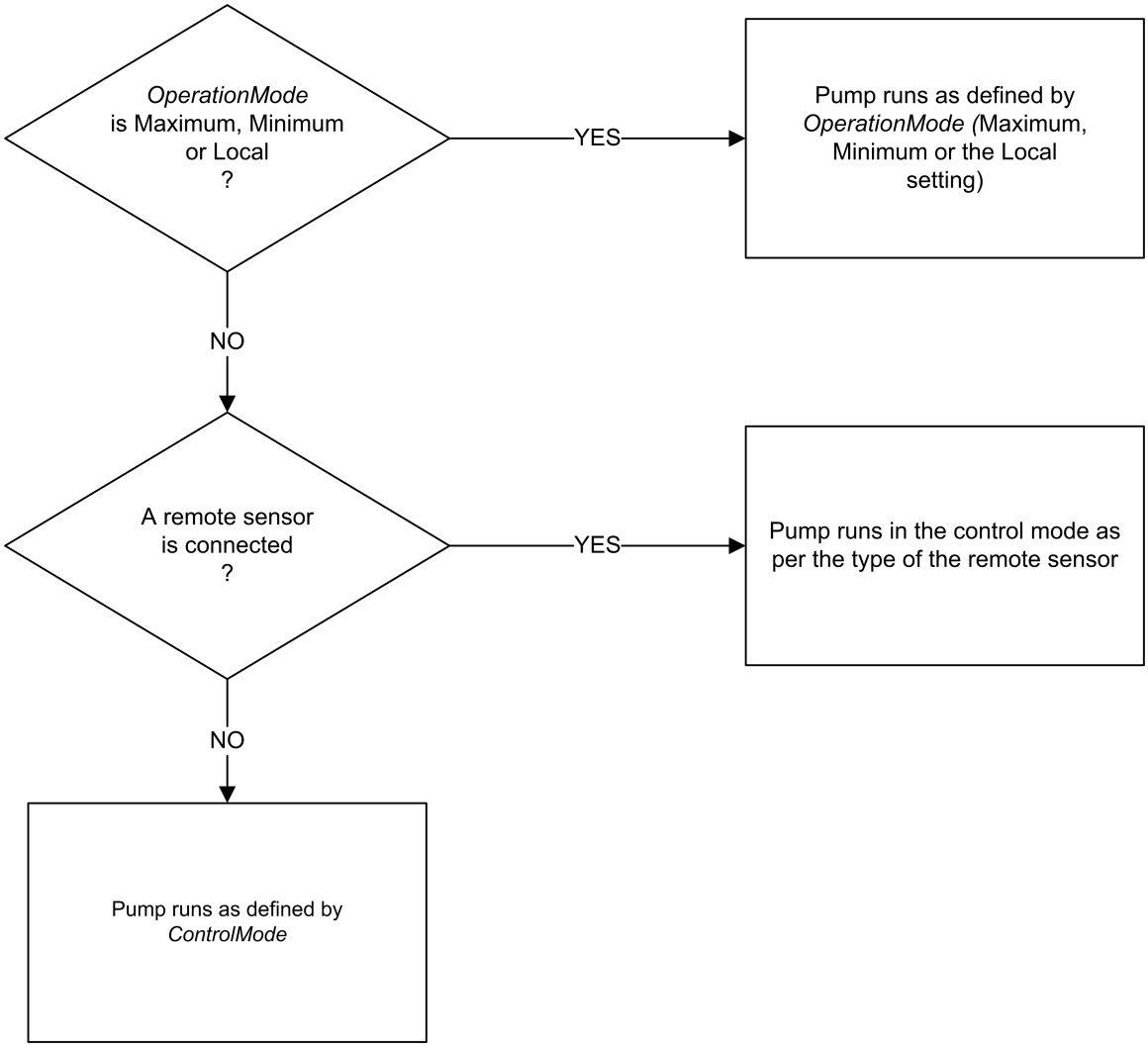
Valid range is 0 kWh to 4,294,967,294 kWh.
This attribute SHALL be null if the value is unknown.

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 *ClusterRevision* 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	Scope	PICS Code
Base	Application	Endpoint	TSTAT

4.3.3. Cluster ID

ID	Name
0x0201	Thermostat

4.3.4. 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

4.3.4.1. Local Temperature Not Exposed (LTNE) feature

This feature indicates that the Calculated Local Temperature 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.

4.3.5. Units of Temperature

Temperatures within this cluster are represented by types using units of degree Celsius.

The temperature data type used throughout this cluster is defined in the Derived Data Types section of the Data Model.

The following temperature-related data types are also defined in and used throughout this cluster:

- TemperatureDifference
- SignedTemperature
- UnsignedTemperature

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.

CAUTION	*Calculations with temperature attributes* 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.

4.3.6. 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:

- AbsMinHeatSetpointLimit <= MinHeatSetpointLimit <= MaxHeatSetpointLimit <= AbsMaxHeatSetpointLimit
- AbsMinCoolSetpointLimit <= MinCoolSetpointLimit <= MaxCoolSetpointLimit <= AbsMaxCoolSetpointLimit

Setpoints must be within user configurable limits:

- MinHeatSetpointLimit <= OccupiedHeatingSetpoint <= MaxHeatSetpointLimit
- MinCoolSetpointLimit <= OccupiedCoolingSetpoint <= MaxCoolSetpointLimit
- MinHeatSetpointLimit <= UnoccupiedHeatingSetpoint <= MaxHeatSetpointLimit
- MinCoolSetpointLimit <= UnoccupiedCoolingSetpoint <= MaxCoolSetpointLimit

and if, and only if, the AUTO feature is supported, a deadband must be maintained between Heating and Cooling setpoints and limits:

- AbsMinHeatSetpointLimit <= (AbsMinCoolSetpointLimit - MinSetpointDeadBand)
- AbsMaxHeatSetpointLimit <= (AbsMaxCoolSetpointLimit - MinSetpointDeadBand)
- MinHeatSetpointLimit <= (MinCoolSetpointLimit - MinSetpointDeadBand)
- MaxHeatSetpointLimit <= (MaxCoolSetpointLimit - MinSetpointDeadBand)
- OccupiedHeatingSetpoint <= (OccupiedCoolingSetpoint - MinSetpointDeadBand)
- UnoccupiedHeatingSetpoint <= (UnoccupiedCoolingSetpoint - MinSetpointDeadBand)

4.3.7. 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.

4.3.8. Data Types

4.3.8.1. TemperatureDifference Type

This data type is derived from int16 and represents a temperature difference with a resolution of 0.01°C.

- *value* = (*temperature in °C*) x 100

- -4°C ⇒ -400
- 123.45°C ⇒ 12345

The full (non-null) range of -327.67°C to 327.67°C may be used.

4.3.8.2. SignedTemperature Type

This data type is derived from int8 and represents a temperature from -12.7°C to 12.7°C with a resolution of 0.1°C.

- *value* = (*temperature in °C*) x 10

- -4°C ⇒ -40
- 12.3°C ⇒ 123

This type is employed where compactness of representation is important and where the resolution and range are still satisfactory.

4.3.8.3. UnsignedTemperature Type

This data type is derived from uint8 and represents a temperature from 0°C to 25.5°C with a resolution of 0.1°C.

- *value* = (*temperature in °C*) x 10

- 4°C ⇒ 40
- 12.3°C ⇒ 123

This type is employed where compactness of representation is important and where the resolution and range are still satisfactory.

4.3.8.4. ACErrorCodeBitmap Type

This data type is derived from map32.

Bit	Name	Summary
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

4.3.8.5. AlarmCodeBitmap Type

This data type is derived from map8.

Bit	Name	Summary
0	**Initialization**	Initialization failure. The device failed to complete initialization at power-up.
1	**Hardware**	Hardware failure
2	**SelfCalibration**	Self-calibration failure

4.3.8.6. HVACSystemTypeBitmap Type

This data type is derived from map8.

Bit	Name	Summary
0..1	**CoolingStage**	Stage of cooling the HVAC system is using.
2..3	**HeatingStage**	Stage of heating the HVAC system is using.
4	**HeatingType**	Type of heating used by the HVAC system.
5	**HeatingFuel**	Type of fuel used by the HVAC system.

4.3.8.6.1. CoolingStage Bits

These bits SHALL indicate what stage of cooling the HVAC system is using.

- 00 = Cool Stage 1
- 01 = Cool Stage 2
- 10 = Cool Stage 3

- 11 = Reserved

4.3.8.6.2. HeatingStage Bits

These bits SHALL indicate what stage of heating the HVAC system is using.

- 00 = Heat Stage 1
- 01 = Heat Stage 2
- 10 = Heat Stage 3
- 11 = Reserved

4.3.8.6.3. HeatingType Bit

This bit SHALL indicate whether the HVAC system is conventional or uses a heat pump.

- 0 = Conventional
- 1 = Heat Pump

4.3.8.6.4. HeatingFuel Bit

This bit SHALL indicate whether the HVAC system is electric or gas.

- 0 = Electric
- 1 = Gas

4.3.8.7. ProgrammingOperationModeBitmap Type

This data type is derived from map8.

Bit	Name	Summary
0	**ScheduleActive**	Schedule programming mode. This enables any programmed weekly schedule configurations.
1	**AutoRecovery**	Auto/recovery mode
2	**Economy**	Economy/EnergyStar mode

4.3.8.8. RelayStateBitmap Type

This data type is derived from map16.

Bit	Name	Summary
0	**Heat**	Heat State On
1	**Cool**	Cool State On
2	**Fan**	Fan State On
3	**HeatStage2**	Heat 2nd State On

Bit	Name	Summary
4	**CoolStage2**	Cool 2nd State On
5	**FanStage2**	Fan 2nd State On
6	**FanStage3**	Fan 3rd Stage On

4.3.8.9. RemoteSensingBitmap Type

This data type is derived from map8.

Bit	Name	Summary	Conformance
0	**LocalTemperature**	Calculated Local Temperature is derived from a remote node	M
1	**OutdoorTemperature**	OutdoorTemperature is derived from a remote node	OutdoorTemperature
2	**Occupancy**	Occupancy is derived from a remote node	OCC

4.3.8.10. DayOfWeek Type

This data type is derived from map8.

Bit	Name	Summary
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

4.3.8.11. ModeForSequence Type

This data type is derived from map8.

Bit	Name	Summary
0	**HeatSetpointPresent**	Adjust Heat Setpoint
1	**CoolSetpointPresent**	Adjust Cool Setpoint

4.3.8.12. SetpointAdjustMode Type

This data type is derived from map8.

Bit	Name	Summary	Conformance
0	**Heat**	Adjust Heat Setpoint	HEAT
1	**Cool**	Adjust Cool Setpoint	COOL
2	**Both**	Adjust Heat Setpoint and Cool Setpoint	HEAT | COOL

4.3.8.13. ACCapacityFormatEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**BTUh**	British Thermal Unit per Hour	O

4.3.8.14. ACCompressorTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Unknown**	Unknown compressor type	O
1	**T1**	Max working ambient 43 °C	O
2	**T2**	Max working ambient 35 °C	O
3	**T3**	Max working ambient 52 °C	O

4.3.8.15. ACLouverPositionEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
1	**Closed**	Fully Closed	O
2	**Open**	Fully Open	O
3	**Quarter**	Quarter Open	O
4	**Half**	Half Open	O
5	**ThreeQuarters**	Three Quarters Open	O

4.3.8.16. ACRefrigerantTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Unknown**	Unknown Refrigerant Type	O
1	**R22**	R22 Refrigerant	O
2	**R410a**	R410a Refrigerant	O
3	**R407c**	R407c Refrigerant	O

4.3.8.17. ACTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Unknown**	Unknown AC Type	O
1	**CoolingFixed**	Cooling and Fixed Speed	O
2	**HeatPumpFixed**	Heat Pump and Fixed Speed	O
3	**CoolingInverter**	Cooling and Inverter	O
4	**HeatPumpInverter**	Heat Pump and Inverter	O

4.3.8.18. ThermostatControlSequence Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**CoolingOnly**	Heat and Emergency are not possible	[COOL]
1	**CoolingWithReheat**	Heat and Emergency are not possible	[COOL]
2	**HeatingOnly**	Cool and precooling (see Terms) are not possible	[HEAT]
3	**HeatingWithReheat**	Cool and precooling are not possible	[HEAT]
4	**CoolingAndHeating**	All modes are possible	[HEAT & COOL]
5	**CoolingAndHeating-WithReheat**	All modes are possible	[HEAT & COOL]

NOTE

CoolingAndHeating

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.

4.3.8.19. SetpointChangeSourceEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Manual**	Manual, user-initiated setpoint change via the thermostat	O
1	**Schedule**	Schedule/internal programming-initiated setpoint change	[SCH]
2	**External**	Externally-initiated setpoint change (e.g., DRLC cluster command, attribute write)	O

4.3.8.20. StartOfWeek Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Sunday**		M
1	**Monday**		M
2	**Tuesday**		M
3	**Wednesday**		M
4	**Thursday**		M
5	**Friday**		M
6	**Saturday**		M

4.3.8.21. ThermostatSystemMode Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Off**	The Thermostat does not generate demand for Cooling or Heating	O
1	**Auto**	Demand is generated for either Cooling or Heating, as required	AUTO
3	**Cool**	Demand is only generated for Cooling	[COOL]
4	**Heat**	Demand is only generated for Heating	[HEAT]
5	**EmergencyHeat**	2nd stage heating is in use to achieve desired temperature	[HEAT]
6	**Precooling**	(see Terms)	[COOL]
7	**Fan only**		O
8	**Dry**		O
9	**Sleep**		O

Table 36. Interpretation of Heat, Cool and Auto ThermostatSystemMode 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

4.3.8.22. TemperatureSetpointHold Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**SetpointHoldOff**	Follow scheduling program	M
1	**SetpointHoldOn**	Maintain current setpoint, regardless of schedule transitions	M

4.3.8.23. ThermostatScheduleTransition Type

This represents a single transition in a Thermostat schedule

ID	Name	Type	Constraint	Quality	Access	Default	Conformance
0	**TransitionTime**	uint16	0 to 1439		RW		M
1	**HeatSetpoint**	temperature	all		RW		M
2	**CoolSetpoint**	temperature	all		RW		M

4.3.8.23.1. TransitionTime Field

This field SHALL represent 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.

4.3.8.23.2. HeatSetpoint Field

This field SHALL represent the heat setpoint to be applied at this associated transition start time.

4.3.8.23.3. CoolSetpoint Field

This field SHALL represent the cool setpoint to be applied at this associated transition start time.

4.3.9. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**LocalTemperature**	temperature	all	XP	null	R V	M
0x0001	**OutdoorTemperature**	temperature	all	X	null	R V	O
0x0002	**Occupancy**	OccupancyBitmap	desc		1	R V	OCC
0x0003	**AbsMinHeatSetpointLimit**	temperature	desc	F	7°C	R V	[HEAT]
0x0004	**AbsMaxHeatSetpointLimit**	temperature	desc	F	30°C	R V	[HEAT]

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0005	**AbsMinCoolSetpointLimit**	temperature	desc	F	16°C	R V	[COOL]
0x0006	**AbsMaxCoolSetpointLimit**	temperature	desc	F	32°C	R V	[COOL]
0x0007	**PICoolingDemand**	uint8	0% to 100%	P	-	R V	[COOL]
0x0008	**PIHeatingDemand**	uint8	0% to 100%	P	-	R V	[HEAT]
0x0009	**HVACSystemTypeConfiguration**	HVACSystemTypeBitmap	desc	N	0	R[W] VM	D
0x0010	**LocalTemperatureCalibration**	SignedTemperature	-2.5°C to 2.5°C	N	0°C	RW VM	[!LTNE]
0x0011	**OccupiedCoolingSetpoint**	temperature	desc	NS	26°C	RW VO	COOL
0x0012	**OccupiedHeatingSetpoint**	temperature	desc	NS	20°C	RW VO	HEAT
0x0013	**UnoccupiedCoolingSetpoint**	temperature	desc	N	26°C	RW VO	COOL & OCC
0x0014	**UnoccupiedHeatingSetpoint**	temperature	desc	N	20°C	RW VO	HEAT & OCC
0x0015	**MinHeatSetpointLimit**	temperature	desc	N	AbsMinHeatSetpointLimit	RW VM	[HEAT]

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0016	**MaxHeatSetpointLimit**	temperature	desc	N	AbsMaxHeatSetpointLimit	RW VM	[HEAT]
0x0017	**MinCoolSetpointLimit**	temperature	desc	N	AbsMinCoolSetpointLimit	RW VM	[COOL]
0x0018	**MaxCoolSetpointLimit**	temperature	desc	N	AbsMaxCoolSetpointLimit	RW VM	[COOL]
0x0019	**MinSetpointDeadBand**	SignedTemperature	0°C to 2.5°C	N	2.5°C	R[W] VM	AUTO
0x001A	**RemoteSensing**	RemoteSensingBitmap	00000xxx	N	0	RW VM	O
0x001B	**ControlSequenceOfOperation**	ThermostatControlSequence	desc	N	4	RW VM	M
0x001C	**SystemMode**	ThermostatSystemMode	desc	NS	1	RW VM	M
0x001D	**AlarmMask**	AlarmCodeBitmap	desc		0	R V	O
0x001E	**ThermostatRunningMode**	ThermostatSystemMode	desc		0	R V	[AUTO]
0x0020	**StartOfWeek**	StartOfWeek	desc	F	–	R V	SCH
0x0021	**NumberOfWeeklyTransitions**	uint8	all	F	0	R V	SCH
0x0022	**NumberOfDailyTransitions**	uint8	all	F	0	R V	SCH

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0023	**TemperatureSetpointHold**	TemperatureSetpointHold	desc	N	0	RW VM	O
0x0024	**TemperatureSetpointHoldDuration**	uint16	0 to 1440	NX	null	RW VM	O
0x0025	**ThermostatProgrammingOperationMode**	ProgrammingOperationModeBitmap	desc	P	0	RW VM	O
0x0029	**ThermostatRunningState**	RelayStateBitmap	desc		-	R V	O
0x0030	**SetpointChangeSource**	SetpointChangeSourceEnum	desc		0	R V	O
0x0031	**SetpointChangeAmount**	TemperatureDifference	all	X	null	R V	O
0x0032	**SetpointChangeSourceTimestamp**	utc	all		0	R V	O
0x0034	**OccupiedSetback**	UnsignedTemperature	OccupiedSetbackMin to OccupiedSetbackMax	XN	null	RW VM	SB
0x0035	**OccupiedSetbackMin**	UnsignedTemperature	0 to OccupiedSetbackMax	XF	null	R V	SB

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0036	**OccupiedSetbackMax**	UnsignedTemperature	OccupiedSetbackMin to 25.4°C	XF	null	R V	SB
0x0037	**UnoccupiedSetback**	UnsignedTemperature	UnoccupiedSetbackMin to UnoccupiedSetbackMax	XN	null	RW VM	SB & OCC
0x0038	**UnoccupiedSetbackMin**	UnsignedTemperature	0 to UnoccupiedSetbackMax	XF	null	R V	SB & OCC
0x0039	**UnoccupiedSetbackMax**	UnsignedTemperature	UnoccupiedSetbackMin to 25.4°C	XF	null	R V	SB & OCC
0x003A	**EmergencyHeatDelta**	UnsignedTemperature	all	N	25.5°C	RW VM	O
0x0040	**ACType**	ACTypeEnum	desc	N	0	RW VM	O
0x0041	**ACCapacity**	uint16	all	N	0	RW VM	O
0x0042	**ACRefrigerantType**	ACRefrigerantTypeEnum	desc	N	0	RW VM	O
0x0043	**ACCompressorType**	ACCompressorTypeEnum	desc	N	0	RW VM	O
0x0044	**ACErrorCode**	ACErrorCodeBitmap	all		0	RW VM	O
0x0045	**ACLouverPosition**	ACLouverPositionEnum	desc	N	0	RW VM	O
0x0046	**ACCoilTemperature**	temperature	all	X	null	R V	O

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0047	**ACCapacityFormat**	ACCapacityFormatEnum	desc	N	0	RW VM	O

4.3.9.1. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following attributes SHALL be part of the ExtensionFieldSetStruct of the Scene Table. If the implicit form of the ExtensionFieldSetStruct is used, the order of the attributes in the AttributeValueList is in the given order, i.e., the attribute listed as 1 is added first:

1. OccupiedCoolingSetpoint
2. OccupiedHeatingSetpoint
3. SystemMode

4.3.9.2. Calculated Local Temperature

The local temperature SHALL be calculated from the *measured temperature*, including any adjustments applied by LocalTemperatureCalibration attribute (if any) as follows:

Calculated Local Temperature = (*measured temperature*) + LocalTemperatureCalibration

The *measured temperature* value may be local, or remote, depending on the value of the RemoteSensing attribute when supported.

All setpoint attributes in the Thermostat cluster SHALL be triggered based off this calculated 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 calculated local temperature even if that value is not reported in the LocalTemperature attribute.

4.3.9.3. LocalTemperature Attribute

This attribute SHALL indicate the current Calculated Local Temperature, when available.

- If the LTNE feature is not supported:
  - If the LocalTemperatureCalibration is invalid or currently unavailable, the attribute SHALL report null.
  - If the LocalTemperatureCalibration is valid, the attribute SHALL report that value.
- Otherwise, if the LTNE feature is supported, there is no feedback externally available for the LocalTemperatureCalibration. In that case, the LocalTemperature attribute SHALL always report null.

4.3.9.4. OutdoorTemperature Attribute

This attribute SHALL indicate the outdoor temperature, as measured locally or remotely (over the network).

4.3.9.5. Occupancy Attribute

This attribute SHALL indicate whether the heated/cooled space is occupied or not, as measured locally or remotely (over the network).

4.3.9.6. AbsMinHeatSetpointLimit Attribute

This attribute SHALL indicate 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

4.3.9.7. AbsMaxHeatSetpointLimit Attribute

This attribute SHALL indicate 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

4.3.9.8. AbsMinCoolSetpointLimit Attribute

This attribute SHALL indicate 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

4.3.9.9. AbsMaxCoolSetpointLimit Attribute

This attribute SHALL indicate 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

4.3.9.10. PICoolingDemand Attribute

This attribute SHALL indicate 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.

4.3.9.11. PIHeatingDemand Attribute

This attribute SHALL indicate 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.

4.3.9.12. HVACSystemTypeConfiguration Attribute

This attribute SHALL indicate 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.

4.3.9.13. LocalTemperatureCalibration Attribute

This attribute SHALL indicate the offset the Thermostat server SHALL make to the measured temperature (locally or remotely) to adjust the Calculated Local Temperature 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.

4.3.9.14. OccupiedCoolingSetpoint Attribute

This attribute SHALL indicate 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.

4.3.9.15. OccupiedHeatingSetpoint Attribute

This attribute SHALL indicate 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.

4.3.9.16. UnoccupiedCoolingSetpoint Attribute

This attribute SHALL indicate 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.

4.3.9.17. UnoccupiedHeatingSetpoint Attribute

This attribute SHALL indicate 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.

4.3.9.18. MinHeatSetpointLimit Attribute

This attribute SHALL indicate 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.

4.3.9.19. MaxHeatSetpointLimit Attribute

This attribute SHALL indicate 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.

4.3.9.20. MinCoolSetpointLimit Attribute

This attribute SHALL indicate 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.

4.3.9.21. MaxCoolSetpointLimit Attribute

This attribute SHALL indicate 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.

4.3.9.22. MinSetpointDeadBand Attribute

On devices which support the AUTO feature, this attribute SHALL indicate 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.

4.3.9.23. RemoteSensing Attribute

This attribute SHALL indicate when the local temperature, outdoor temperature and occupancy are being sensed by remote networked sensors, rather than internal sensors.

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.

4.3.9.24. ControlSequenceOfOperation Attribute

This attribute SHALL indicate the overall operating environment of the thermostat, and thus the possible system modes that the thermostat can operate in.

4.3.9.25. SystemMode Attribute

This attribute SHALL indicate the current operating mode of the thermostat. Its value SHALL be limited by the ControlSequenceOfOperation attribute.

4.3.9.26. AlarmMask Attribute

This attribute SHALL indicate whether each of the alarms in AlarmCodeBitmap is enabled.

When the Alarms cluster is implemented on a device, and one of the alarm conditions included in AlarmCodeBitmap occurs, an alarm notification is generated, with the alarm code field set as listed in AlarmCodeBitmap.

4.3.9.27. ThermostatRunningMode Attribute

This attribute SHALL indicate the running mode of the thermostat. This attribute uses the ThermostatSystemMode 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.

4.3.9.28. StartOfWeek Attribute

This attribute SHALL indicate the day of the week that this thermostat considers to be the start of

week for weekly set point scheduling.

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.

4.3.9.29. NumberOfWeeklyTransitions Attribute

This attribute SHALL indicate how many weekly schedule transitions the thermostat is capable of handling.

4.3.9.30. NumberOfDailyTransitions Attribute

This attribute SHALL indicate how many daily schedule transitions the thermostat is capable of handling.

4.3.9.31. TemperatureSetpointHold Attribute

This attribute SHALL indicate 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.

4.3.9.32. TemperatureSetpointHoldDuration Attribute

This attribute SHALL indicate 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.

4.3.9.33. ThermostatProgrammingOperationMode Attribute

This attribute SHALL indicate 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 ProgrammingOperationModeBitmap. 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.

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.

4.3.9.34. ThermostatRunningState Attribute

This attribute SHALL indicate the current relay state of the heat, cool, and fan relays.

Unimplemented outputs SHALL be treated as if they were Off.

4.3.9.35. SetpointChangeSource Attribute

This attribute SHALL indicate 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.

4.3.9.36. SetpointChangeAmount Attribute

This attribute SHALL indicate 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.

4.3.9.37. SetpointChangeSourceTimestamp Attribute

This attribute SHALL indicate the time in UTC at which the SetpointChangeAmount attribute change was recorded.

4.3.9.38. OccupiedSetback Attribute

This attribute SHALL indicate the amount that the Thermostat server will allow the Calculated Local Temperature to float above the OccupiedCoolingSetpoint (i.e., OccupiedCoolingSetpoint + OccupiedSetback) or below the OccupiedHeatingSetpoint setpoint (i.e., OccupiedHeatingSetpoint – 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 setpoint 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.

4.3.9.39. OccupiedSetbackMin Attribute

This attribute SHALL indicate 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.

4.3.9.40. OccupiedSetbackMax Attribute

This attribute SHALL indicate 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.

4.3.9.41. UnoccupiedSetback Attribute

This attribute SHALL indicate the amount that the Thermostat server will allow the Calculated Local Temperature to float above the UnoccupiedCoolingSetpoint (i.e., UnoccupiedCoolingSetpoint + UnoccupiedSetback) or below the UnoccupiedHeatingSetpoint setpoint (i.e., UnoccupiedHeatingSetpoint - 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 setpoint 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.

4.3.9.42. UnoccupiedSetbackMin Attribute

This attribute SHALL indicate 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.

4.3.9.43. UnoccupiedSetbackMax Attribute

This attribute SHALL indicate 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.

4.3.9.44. EmergencyHeatDelta Attribute

This attribute SHALL indicate the delta between the Calculated Local Temperature and the OccupiedHeatingSetpoint or UnoccupiedHeatingSetpoint attributes at which the Thermostat server will operate in emergency heat mode.

If the difference between the Calculated Local Temperature and OccupiedCoolingSetpoint or UnoccupiedCoolingSetpoint 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:

- Calculated Local Temperature = 10.0°C
- OccupiedHeatingSetpoint = 16.0°C
- EmergencyHeatDelta = 2.0°C

⇒ OccupiedHeatingSetpoint - Calculated Local Temperature ≥? 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.

4.3.9.45. ACType Attribute

This attribute SHALL indicate the type of Mini Split ACTypeEnum of Mini Split AC is defined depending on how Cooling and Heating condition is achieved by Mini Split AC.

4.3.9.46. ACCapacity Attribute

This attribute SHALL indicate capacity of Mini Split AC in terms of the format defined by the ACCapacityFormat attribute

4.3.9.47. ACRefrigerantType Attribute

This attribute SHALL indicate type of refrigerant used within the Mini Split AC.

4.3.9.48. ACCompressorType Attribute

This attribute SHALL indicate the type of compressor used within the Mini Split AC.

4.3.9.49. ACErrorCode Attribute

This attribute SHALL indicate the type of errors encountered within the Mini Split AC.

4.3.9.50. ACLouverPosition Attribute

This attribute SHALL indicate the position of Louver on the AC.

4.3.9.51. ACCoilTemperature Attribute

This attribute SHALL indicate the temperature of the AC coil, as measured locally or remotely (over the network).

4.3.9.52. ACCapacityFormat Attribute

This attribute SHALL indicate the format for the ACCapacity attribute.

4.3.10. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**SetpointRaiseLower**	client ⇒ server	Y	O	M
0x01	**SetWeeklySchedule**	client ⇒ server	Y	M	SCH
0x02	**GetWeeklySchedule**	client ⇒ server	GetWeeklyScheduleResponse	O	SCH
0x03	**ClearWeeklySchedule**	client ⇒ server	N	M	SCH
0x04	**GetRelayStatusLog**	client ⇒ server	GetRelayStatusLogResponse	O	O
0x00	**GetWeeklyScheduleResponse**	client ⇐ server	N		SCH
0x01	**GetRelayStatusLogResponse**	client ⇐ server	N		GetRelayStatusLog

4.3.10.1. SetpointRaiseLower 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**	SetpointAdjustMode	desc			M

ID	Field	Type	Constraint	Quality	Default	Conformance
1	**Amount**	int8	all			M

4.3.10.2. Mode Field

The field SHALL specify which setpoints are to be adjusted.

4.3.10.2.1. Heat Bit

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.

4.3.10.2.2. Cool Bit

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.

4.3.10.2.3. Both Bit

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.

4.3.10.3. Amount Field

This field SHALL indicate the amount (possibly negative) that should be added to the setpoint(s), in steps of 0.1°C.

4.3.10.4. SetWeeklySchedule 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	**NumberOfTransitionsForSequence**	uint8	all			M
1	**DayOfWeekforSequence**	DayOfWeek	desc			M
2	**ModeForSequence**	ModeForSequence	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.

4.3.10.5. NumberOfTransitionsForSequence Field

This field SHALL indicate 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.

4.3.10.6. DayOfWeekforSequence Field

This field SHALL represent 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).

Each set point transition will begin with the day of week for this transition. There can be up to 10 transitions for each command.

4.3.10.7. ModeForSequence Field

This field SHALL indicate how the application decodes the setpoint fields of each transition in the Transitions list.

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.

4.3.10.8. Transitions Field

This field SHALL contain the list of setpoint transitions used to update the specified daily schedules

4.3.10.9. GetWeeklySchedule Command

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**	DayOfWeek	desc			M
1	**ModeToReturn**	ModeForSequence	desc			M

4.3.10.9.1. DaysToReturn Field

This field SHALL indicate 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.

4.3.10.9.2. ModeToReturn Field

This field SHALL indicate 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.

4.3.10.10. ClearWeeklySchedule Command

This 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.

4.3.10.11. GetRelayStatusLog Command

This 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

ii. 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.

4.3.10.12. GetWeeklyScheduleResponse Command

This command has the same payload format as the Set Weekly Schedule. Please refer to the payload detail in SetWeeklySchedule.

4.3.10.13. GetRelayStatusLogResponse Command

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**	RelayStateBitmap	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

4.3.10.13.1. TimeOfDay Field

This field SHALL indicate 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.

4.3.10.13.2. RelayStatus Field

This field SHALL indicate 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 bitmap and the associated relay.

4.3.10.13.3. LocalTemperature Field

This field SHALL indicate the LocalTemperature when the log is captured. The null value indicates that LocalTemperature was invalid or unavailable.

4.3.10.13.4. Humidity Field

This field SHALL indicate the humidity as a percentage when the log was captured. The null value indicates that the humidity value was invalid or unknown.

4.3.10.13.5. Setpoint Field

This field SHALL indicate the target setpoint temperature when the log is captured.

4.3.10.13.6. UnreadEntries Field

This field SHALL indicate the number of unread entries within the thermostat internal log system.

4.4. Fan Control Cluster

This cluster specifies an interface to control the speed of a fan.

NOTE	Support for Fan Control cluster is provisional.

4.4.1. 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; Percent, speed and motion settings; General cleanup
3	Addition of Airflow Direction and Step command
4	Change conformance for FanModeSequenceEnum

4.4.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	FAN

4.4.3. Cluster ID

ID	Name
0x0202	Fan Control

4.4.4. Features

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

Bit	Code	Feature	Summary
0	**SPD**	MultiSpeed	1-100 speeds
1	**AUT**	Auto	Automatic mode supported for fan speed
2	**RCK**	Rocking	Rocking movement supported
3	**WND**	Wind	Wind emulation supported

Bit	Code	Feature	Summary
4	**STEP**	Step	Step command supported
5	**DIR**	Airflow Direction	Airflow Direction attribute is supported

4.4.4.1. MultiSpeed 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 MultiSpeed feature includes new attributes that support a running fan speed value from 1 to a maximum of 100. See Speed Rules for more details.

4.4.5. Data Types

4.4.5.1. RockBitmap Type

Bit	Name	Summary	Conformance
0	**RockLeftRight**	Indicate rock left to right	M
1	**RockUpDown**	Indicate rock up and down	M
2	**RockRound**	Indicate rock around	M

4.4.5.2. WindBitmap Type

Bit	Name	Summary	Conformance
0	**SleepWind**	Indicate sleep wind	M
1	**NaturalWind**	Indicate natural wind	M

4.4.5.2.1. SleepWind Value

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.

4.4.5.2.2. NaturalWind Value

The fan speed SHALL vary to emulate natural wind. For this setting, the sequence, speeds and duration are MS.

4.4.5.3. StepDirectionEnum Type

Value	Name	Summary	Conformance
0	**Increase**	Step moves in increasing direction	M
1	**Decrease**	Step moves in decreasing direction	M

4.4.5.4. AirflowDirectionEnum Type

Value	Name	Summary	Conformance
0	**Forward**	Airflow is in the forward direction	M
1	**Reverse**	Airflow is in the reverse direction	M

4.4.5.5. FanModeEnum Type

Value	Name	Summary	Conformance
0	**Off**	Fan is off	M
1	**Low**	Fan using low speed	desc
2	**Medium**	Fan using medium speed	desc
3	**High**	Fan using high speed	M
4	**On**		D
5	**Auto**	Fan is using auto mode	AUT
6	**Smart**	Fan is using smart mode	D

4.4.5.5.1. Low Value

If the fan supports 2 or more speeds, the Low value SHALL be supported.

The Low value SHALL be supported if and only if the FanModeSequence attribute value is less than 4.

4.4.5.5.2. Medium Value

If the fan supports 3 or more speeds, the Medium value SHALL be supported.

The Medium value SHALL be supported if and only if the FanModeSequence attribute value is 0 or 2.

4.4.5.6. FanModeSequenceEnum Type

Value	Name	Summary	Conformance
0	**Off/Low/Med/High**	Fan is capable of off, low, medium and high modes	[!AUT].a
1	**Off/Low/High**	Fan is capable of off, low and high modes	[!AUT].a
2	**Off/Low/Med/High/Auto**	Fan is capable of off, low, medium, high and auto modes	[AUT].a
3	**Off/Low/High/Auto**	Fan is capable of off, low, high and auto modes	[AUT].a
4	**Off/High/Auto**	Fan is capable of off, high and auto modes	[AUT].a
5	**Off/High**	Fan is capable of off and high modes	[!AUT].a

4.4.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**FanMode**	FanModeEnum	0 to 6	N	0	RW VO	M
0x0001	**FanModeSequence**	FanModeSequenceEnum	0 to 5	N	MS	R[W] VO	Zigbee
0x0001	**FanModeSequence**	FanModeSequenceEnum	0 to 5	F	MS	R V	M
0x0002	**PercentSetting**	percent	0 to 100	X	0	RW VO	M
0x0003	**PercentCurrent**	percent	0 to 100		desc	R V	M
0x0004	**SpeedMax**	uint8	1 to 100	F	MS	R V	SPD
0x0005	**SpeedSetting**	uint8	0 to SpeedMax	X	0	RW VO	SPD
0x0006	**SpeedCurrent**	uint8	0 to SpeedMax	P	desc	R V	SPD

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0007	**RockSupport**	RockBitmap	desc	F	0	R V	RCK
0x0008	**RockSetting**	RockBitmap	desc	P	0	RW VO	RCK
0x0009	**WindSupport**	WindBitmap	desc	F	0	R V	WND
0x000A	**WindSetting**	WindBitmap	desc	P	0	RW VO	WND
0x000B	**AirflowDirection**	AirflowDirectionEnum	desc	P	0	RW VO	DIR

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 FanModeEnum.

When the FanMode attribute is written to, the PercentSetting and SpeedSetting (if present) attributes SHALL be set to appropriate values, as defined by the Percent Rules and Speed Rules respectively, unless otherwise specified below.

When the FanMode attribute is set to any given mode, the PercentCurrent and SpeedCurrent (if present) SHALL indicate the actual currently operating fan speed, unless otherwise specified below.

4.4.6.1.1. Off Value

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. Auto Value

Setting the attribute value to Auto SHALL set the values of these attributes to null:

- PercentSetting
- SpeedSetting (if present)

These attributes SHALL continue to indicate the current state of the fan while this attribute value is Auto:

- PercentCurrent
- SpeedCurrent (if present)

4.4.6.1.3. On Value

If a client attempts to write a value of On, the attribute SHALL be set to High.

4.4.6.1.4. Smart Value

If a client attempts to write a value of Smart and the AUT feature is supported, the attribute SHALL be set to Auto, otherwise the attribute SHALL be set to High.

4.4.6.2. FanModeSequence Attribute

This attribute indicates the fan speed ranges that SHALL be supported.

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 MultiSpeed 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 Percent Rules 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 Speed Rules 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.

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.

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.

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.

4.4.6.12. AirflowDirection Attribute

This attribute SHALL indicate the current airflow direction of the fan. This attribute MAY be written by the client to indicate a new airflow direction for the fan. This attribute SHALL be set to one of the values in the AirflowDirectionEnum table.

4.4.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**Step**	client ⇒ server	Y	O	STEP

4.4.7.1. Step Command

This command speeds up or slows down the fan, in steps, without the client having to know the fan speed. This command supports, for example, a user operated wall switch, where the user provides the feedback or control to stop sending this command when the proper speed is reached. The step speed values are implementation specific. How many step speeds are implemented is implementation specific.

This command supports these fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Direction**	StepDirectionEnum			Increase	M
1	**Wrap**	bool			false	O
2	**LowestOff**	bool			true	O

4.4.7.1.1. Direction Field

This field SHALL indicate whether the fan speed increases or decreases to the next step value.

4.4.7.1.2. Wrap Field

This field SHALL indicate if the fan speed wraps between highest and lowest step value.

4.4.7.1.3. LowestOff Field

This field SHALL indicate that the fan being off (speed value 0) is included as a step value.

4.4.7.1.4. When Generated

The client sends this command to speed the fan up or down in a step by step fashion.

4.4.7.1.5. Effect Upon Receipt

- This command SHALL be executed even if the fan speed is not currently at an implemented step value.
- If the Direction field is Increase,
  - If the fan speed is lower than the highest step value, the fan speed SHALL change to the lowest step value that is higher than the current fan speed.
  - Else if Wrap is TRUE, the fan speed SHALL change to the lowest step value.
  - Else the fan speed SHALL change to (or remain at) the highest step value.
- If the Direction field is Decrease,
  - If the fan speed is higher than the lowest step value, the fan speed SHALL change to the highest step value that is lower than the current fan speed.
  - Else if Wrap is TRUE, the fan speed SHALL change to the highest step value.
  - Else the fan speed SHALL change to (or remain at) the lowest step value.
- Although the effect of the Step command is implementation specific, the effect on receipt of the Step command SHALL adhere to the conformance of the affected attributes.

4.5. Thermostat User Interface Configuration Cluster

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	Scope	PICS Code
Base	Application	Endpoint	TSUIC

4.5.3. Cluster ID

ID	Name
0x0204	Thermostat User Interface Configuration

4.5.4. Conversion of Temperature Values for Display

See the Temperature Conversion section in the Data Model for unit conversion between Fahrenheit and Celsius.

4.5.5. Data Types

4.5.5.1. TemperatureDisplayModeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Celsius**	Temperature displayed in °C	M
1	**Fahrenheit**	Temperature displayed in °F	M

4.5.5.2. KeypadLockoutEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**NoLockout**	All functionality available to the user	M
1	**Lockout1**	Level 1 reduced functionality	M
2	**Lockout2**	Level 2 reduced functionality	M
3	**Lockout3**	Level 3 reduced functionality	M
4	**Lockout4**	Level 4 reduced functionality	M
5	**Lockout5**	Least functionality available to the user	M

The interpretation of the various levels is device-dependent.

4.5.5.3. ScheduleProgrammingVisibilityEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**ScheduleProgrammingPermitted**	Local schedule programming functionality is enabled at the thermostat	M
1	**ScheduleProgrammingDenied**	Local schedule programming functionality is disabled at the thermostat	M

4.5.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**TemperatureDisplayMode**	TemperatureDisplayModeEnum	desc		Celsius	RW VO	M
0x0001	**KeypadLockout**	KeypadLockoutEnum	desc		NoLockout	RW VM	M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0002	**ScheduleProgrammingVisibility**	ScheduleProgrammingVisibilityEnum	desc		ScheduleProgrammingPermitted	RW VM	O

4.5.6.1. TemperatureDisplayMode Attribute

This attribute SHALL indicate the units of the temperature displayed on the thermostat screen.

4.5.6.2. KeypadLockout Attribute

This attribute SHALL indicate the level of functionality that is available to the user via the keypad.

4.5.6.3. ScheduleProgrammingVisibility Attribute

This 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.

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

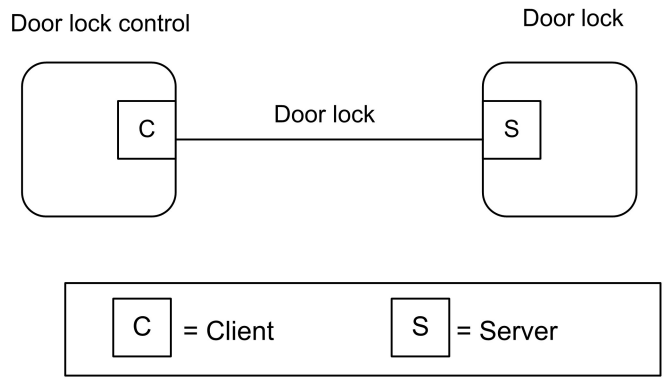
The clusters specified in this document are for use typically in applications involving closures (e.g., shades, windows, doors), but MAY be used in any application domain.

5.1.2. Cluster List

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

Table 37. Overview of the Closures Clusters

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.

5.2.2. 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
7	Added support for European door locks (unbolt feature)

5.2.3. Classification

Hierarchy	Role	Context	PICS Code
Base	Application	Endpoint	DRLK

5.2.4. Cluster ID

ID	Name
0x0101	Door Lock

5.2.5. Features

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

Bit	Code	Feature	Conformance	Summary
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	Summary
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
12	**UBOLT**	Unbolting	O	Lock supports unbolting

5.2.5.1. 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.

5.2.5.2. 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.

5.2.5.3. 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.

5.2.5.4. 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.

5.2.5.5. 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.

5.2.5.6. 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.

5.2.5.7. 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.

5.2.5.8. 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.

5.2.5.9. 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.

5.2.5.10. Notification Feature

This is a feature used before support of events. This feature supports notification commands and masks used to filter these notifications.

5.2.5.11. 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.

5.2.5.12. 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.

5.2.5.13. Unbolting Feature

Locks that support this feature differentiate between unbolting and unlocking. The Unbolt Door command retracts the bolt without pulling the latch. The Unlock Door command fully unlocks the door by retracting the bolt and briefly pulling the latch. While the latch is pulled, the lock state changes to Unlatched. Locks without unbolting support don't differentiate between unbolting and unlocking and perform the same operation for both commands.

5.2.5.13.1. 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.

5.2.6. 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
0x0004	**DoorOpenEvents**	uint32	all			RW VM	[DPS]
0x0005	**DoorClosedEvents**	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	**NumberOfWeekDaySchedulesSupportedPerUser**	uint8	all	F	0	R V	WDSCH

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0015	**NumberOfYearDaySchedulesSupportedPerUser**	uint8	all	F	0	R V	YDSCH
0x0016	**NumberOfHolidaySchedulesSupported**	uint8	all	F	0	R V	HDSCH
0x0017	**MaxPINCodeLength**	uint8	all	F	MS	R V	PIN
0x0018	**MinPINCodeLength**	uint8	all	F	MS	R V	PIN
0x0019	**MaxRFIDCodeLength**	uint8	all	F	MS	R V	RID
0x001A	**MinRFIDCodeLength**	uint8	all	F	MS	R V	RID
0x001B	**CredentialRulesSupport**	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	**AutoRelockTime**	uint32	all	P	MS	R[W] VM	O

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0024	**SoundVolume**	uint8	desc	P	0	R[W] VM	O
0x0025	**OperatingMode**	enum8	desc	P	0	R[W] VM	M
0x0026	**SupportedOperatingModes**	map16	all	F	0xFFF6	R V	M
0x0027	**DefaultConfigurationRegister**	map16	all	P	0	R V	O
0x0028	**EnableLocalProgramming**	bool	all	P	1	R[W] VA	O
0x0029	**EnableOne-TouchLocking**	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	[!USR & PIN]

Id	Name	Type	Constraint	Quality	Default	Access	Conformance
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	**AlarmMask**	map16	all	P	0xFFFF	RW VA	O
0x0041	**KeypadOperationEventMask**	map16	all	P	0xFFFF	RW VA	[NOT & PIN]
0x0042	**RemoteOperationEventMask**	map16	all	P	0xFFFF	RW VA	[NOT]
0x0043	**ManualOperationEventMask**	map16	all	P	0xFFFF	RW VA	[NOT]
0x0044	**RFIDOperationEventMask**	map16	all	P	0xFFFF	RW VA	[NOT & RID]
0x0045	**KeypadProgrammingEventMask**	map16	all	P	0xFFFF	RW VA	[NOT & PIN]
0x0046	**RemoteProgrammingEventMask**	map16	all	P	0xFFFF	RW VA	[NOT]
0x0047	**RFIDProgrammingEventMask**	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.

5.2.6.1. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following attribute SHALL be part of the ExtensionFieldSetStruct of 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 Locked SHALL command the lock to lock.
- Setting the LockState to Unlocked SHALL command the lock to unlock.
- If a lock supports the Unbolting Feature, setting the LockState to Unlocked SHALL unlock the door without pulling the latch.
- Setting the LockState attribute to Unlatched SHALL command the lock to unlock and pull the latch.
- Trying to write the LockState attribute to Not Fully Locked SHALL be ignored and not change the state of the lock.

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.

5.2.6.2. LockState Attribute

This attribute has the following possible values:

Value	Name	Conformance	Summary
0	**Not Fully Locked**	M	Lock state is not fully locked
1	**Locked**	M	Lock state is fully locked
2	**Unlocked**	M	Lock state is fully unlocked
3	**Unlatched**	O	Lock state is fully unlocked and the latch is pulled

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.

5.2.6.3. LockType Attribute

The LockType attribute is indicated by an enumeration:

Value	Name	Summary
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
10	**Door Furniture**	Physical lock type is door furniture
11	**Eurocylinder**	Physical lock type is eurocylinder

5.2.6.4. 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	Summary
0	Disabled
1	Enabled

5.2.6.5. 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.

5.2.6.6. DoorOpenEvents Attribute

This attribute holds the number of door open events that have occurred since it was last zeroed.

5.2.6.7. DoorClosedEvents Attribute

This attribute holds the number of door closed events that have occurred since it was last zeroed.

5.2.6.8. OpenPeriod Attribute

This attribute holds the number of minutes the door has been open since the last time it transitioned from closed to open.

5.2.6.9. NumberOfLogRecordsSupported Attribute

The number of available log records.

5.2.6.10. NumberOfTotalUsersSupported Attribute

Number of total users supported by the lock.

5.2.6.11. NumberOfPINUsersSupported Attribute

The number of PIN users supported.

5.2.6.12. NumberOfRFIDUsersSupported Attribute

The number of RFID users supported.

5.2.6.13. NumberOfWeekDaySchedulesSupportedPerUser Attribute

The number of configurable week day schedule supported per user.

5.2.6.14. NumberOfYearDaySchedulesSupportedPerUser Attribute

The number of configurable year day schedule supported per user.

5.2.6.15. NumberOfHolidaySchedulesSupported Attribute

The number of holiday schedules supported for the entire door lock device.

5.2.6.16. MaxPINCodeLength Attribute

An 8 bit value indicates the maximum length in bytes of a PIN Code on this device.

5.2.6.17. MinPINCodeLength Attribute

An 8 bit value indicates the minimum length in bytes of a PIN Code on this device.

5.2.6.18. 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.

5.2.6.19. 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.

5.2.6.20. CredentialRulesSupport Attribute

This bitmap contains a bit for every value of CredentialRuleEnum supported on this device.

Bit	Name	Summary
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

5.2.6.21. 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.

5.2.6.22. 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.

5.2.6.23. Language Attribute

Modifies the language for the on-screen or audible user interface using a 2-byte language code from ISO-639-1.

5.2.6.24. OperatingMode Attribute

The current operating mode of the lock (see OperatingModeEnum).

5.2.6.25. 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	Name	Conformance
0	Normal	M
1	Vacation	O
2	Privacy	O
3	NoRemoteLockUnlock	M
4	Passage	O

5.2.6.26. LEDSettings Attribute

The settings for the LED support three different modes, shown below:

Value	Name
0	**Never use LED for signalization**
1	**Use LED signalization except for access allowed events**
2	**Use LED signalization for all events**

5.2.6.27. 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.

5.2.6.28. SoundVolume Attribute

The sound volume on a door lock has four possible settings: silent, low, high and medium volumes, shown below:

Value	Name
0	Silent Mode
1	Low Volume
2	High Volume
3	Medium Volume

5.2.6.29. 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	Name	Summary
0	Local Programming	0 - Enable Local Programming Attribute default value is 0 (disabled) 1 - Enable Local Programming Attribute default value is 1 (enabled)
1	Keypad Interface	0 –Keypad Interface default access is disabled 1 - Keypad Interface default access is enabled
2	Remote Interface	0 - Remote Interface default access is disabled 1 - Remote Interface default access is enabled
5	Sound Volume	0 – Sound Volume attribute default value is 0 (Silent Mode) 1 – Sound Volume attribute default value is equal to something other than 0
6	Auto Relock	0 – Auto Relock Time attribute default value = 0 1 – Auto Relock Time attribute default value is equal to something other than 0

Bit	Name	Summary
7	LED Settings	0 – LED Settings attribute default value = 0 1 – LED Settings attribute default value is equal to something other than 0

5.2.6.30. 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.

5.2.6.31. EnableOneTouchLocking Attribute

Enable/disable the ability to lock the door lock with a single touch on the door lock.

5.2.6.32. EnableInsideStatusLED Attribute

Enable/disable an inside LED that allows the user to see at a glance if the door is locked.

5.2.6.33. 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.

5.2.6.34. 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	Name	Summary
0	Add Locally	0 - The ability to add Users/credentials/Schedules locally is disabled 1 - The ability to add Users/Credentials/Schedules locally is enabled

Bit	Name	Summary
1	Modify Locally	0 - The ability to modify Users/credentials/Schedules locally is disabled 1 - The ability to modify Users/Credentials/Schedules locally is enabled
2	Clear Locally	0 - The ability to clear Users/credentials/Schedules locally is disabled 1 - The ability to clear Users/Credentials/Schedules locally is enabled
3	Adjust Locally	0 - The ability to adjust lock settings locally is disabled 1 - The ability to adjust lock settings locally is enabled

5.2.6.35. WrongCodeEntryLimit Attribute

The number of incorrect Pin codes or RFID presentment 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.

5.2.6.36. 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.

5.2.6.37. 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.

5.2.6.38. 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.

5.2.6.39. 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.

5.2.6.40. 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.

Name	Bit	Summary	Conformance
Alarm Code 0	0	Locking Mechanism Jammed	M
Alarm Code 1	1	Lock Reset to Factory Defaults	O
Alarm Code 2	2	Reserved	O
Alarm Code 3	3	RF Module Power Cycled	O
Alarm Code 4	4	Tamper Alarm - wrong code entry limit	PIN | RID
Alarm Code 5	5	Tamper Alarm - front escutcheon removed from main	O
Alarm Code 6	6	Forced Door Open under Door Locked Condition	O

5.2.6.41. 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	Name	Bit	Summary
0	Operation Event Code 0	0	Unknown or manufacturer-specific keypad operation event
0	Operation Event Code 1	1	Lock, source: keypad
0	Operation Event Code 2	2	Unlock, source: keypad
0	Operation Event Code 3	3	Lock, source: keypad, error: invalid PIN
0	Operation Event Code 4	4	Lock, source: keypad, error: invalid schedule
0	Operation Event Code 5	5	Unlock, source: keypad, error: invalid code
0	Operation Event Code 6	6	Unlock, source: keypad, error: invalid schedule
0	Operation Event Code 15	7	Non-Access User operation event, source keypad.

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.6.42. 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	Name	Bit	Summary
1	Operation Event Code 0	0	Unknown or manufacturer-specific remote operation event
1	Operation Event Code 1	1	Lock, source: remote
1	Operation Event Code 2	2	Unlock, source: remote
1	Operation Event Code 3	3	Lock, source: remote, error: invalid code

Event Source	Name	Bit	Summary
1	Operation Event Code 4	4	Lock, source: remote, error: invalid schedule
1	Operation Event Code 5	5	Unlock, source: remote, error: invalid code
1	Operation Event Code 6	6	Unlock, source: remote, error: invalid schedule

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.6.43. 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	Name	Bit	Summary
2	Operation Even Code 0	0	Unknown or manufacturer-specific manual operation event
2	Operation Even Code 1	1	Thumbturn Lock
2	Operation Even Code 2	2	Thumbturn Unlock
2	Operation Even Code 7	3	One touch lock
2	Operation Even Code 8	4	Key Lock
2	Operation Even Code 9	5	Key Unlock
2	Operation Even Code 10	6	Auto lock
2	Operation Even Code 11	7	Schedule Lock
2	Operation Even Code 12	8	Schedule Unlock
2	Operation Even Code 13	9	Manual Lock (Key or Thumbturn)
2	Operation Even Code 14	10	Manual Unlock (Key or Thumbturn)

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.6.44. RFIDOperationEventMask Attribute

Event mask used to turn on and off RFID operation events. This mask DOES NOT apply to the stor-

ing 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	Name	Bit	Summary
3	Operation Event Code 0	0	Unknown or manufacturer-specific keypad operation event
3	Operation Event Code 1	1	Lock, source: RFID
3	Operation Event Code 2	2	Unlock, source: RFID
3	Operation Event Code 3	3	Lock, source: RFID, error: invalid RFID ID
3	Operation Event Code 4	4	Lock, source: RFID, error: invalid schedule
3	Operation Event Code 5	5	Unlock, source: RFID, error: invalid RFID ID
3	Operation Event Code 6	6	Unlock, source: RFID, error: invalid schedule

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.6.45. 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	Name	Bit	Summary
0	Program Event Code 0	0	Unknown or manufacturer-specific keypad programming event

Event Source	Name	Bit	Summary
0	Program Event Code 1	1	Programming PIN code changed, source: key-pad User ID: programming user ID. PIN: default or pro-gramming PIN code if codes can be sent over the air per attribute. User type: default User Status: default
0	Program Event Code 2	2	PIN added, source: key-pad User ID: user ID that was added. PIN: code 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.
0	Program Event Code 3	3	PIN cleared, source: keypad User ID: user ID that was cleared. PIN: code that was cleared (if codes can be sent over the air per attribute.) User type: default or type cleared. User Status: default or status cleared.

Event Source	Name	Bit	Summary
0	Program Event Code 4	4	PIN changed Source: keypad User ID: user ID that was changed PIN: code that was changed (if codes can be sent over the air per attribute.) User type: default or type changed. User Status: default or status changed.

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.6.46. 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	Name	Bit	Summary
1	Program Event Code 0	0	Unknown or manufacturer-specific remote programming event.
1	Program Event Code 2	2	PIN added, source remote Same as keypad source above
1	Program Event Code 3	3	PIN cleared, source remote Same as keypad source above.

Event Source	Name	Bit	Summary
1	Program Event Code 4	4	PIN changed Source remote Same as keypad source above
1	Program Event Code 5	5	RFID code added, Source remote
1	Program Event Code 6	6	RFID code cleared, Source remote

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.6.47. 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	Name	Bit	Summary
3	Program Event Code 0	0	Unknown or manufacturer-specific keypad programming event
3	Program Event Code 5	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	Name	Bit	Summary
3	Program Event Code 6	6	ID cleared, Source: RFID User ID: user ID that was cleared. ID: ID that was cleared (if codes can be sent over the air per attribute.) User Type: default or type cleared. User Status: default or status cleared.

This mask DOES NOT apply to the Events mechanism of this cluster.

5.2.7. 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
0x27	**Unbolt Door**	Client ⇒ Server	Y	T O	UBOLT

5.2.7.1. 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 RequirePINForRemoteOperation attribute.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**PINCode** **PIN/RFID Code†**	octstr				[COTA & PIN]

† The PIN/RFID Code is an obsolete field name, use PINCode instead.

5.2.7.1.1. PINCode Field

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.

5.2.7.2. 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 RequirePINForRemoteOperation 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** **PIN/RFID Code†**	octstr				[COTA & PIN]

† The PIN/RFID Code is an obsolete field name, use PINCode instead.

5.2.7.2.1. PINCode Field

See PINCode Field.

5.2.7.3. 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.

5.2.7.3.1. Timeout Field

The timeout in seconds to wait before relocking the door lock. This value is independent of the AutoRelockTime attribute value.

5.2.7.3.2. PINCode Field

See PINCode Field.

5.2.7.4. 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.

5.2.7.5. 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

Id	Field	Type	Constraint	Quality	Default	Conformance
1	**Timestamp**	epoch-s	all			M
2	**Event Type**	enum8	desc			M
3	**Source**	uint8	desc			M
4	**Event ID/Alarm Code**	uint8	desc			M
5	**User ID**	uint16	desc			M
6	**PIN**	octstr				M

5.2.7.5.1. Log Entry ID Field

This is 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.

5.2.7.5.2. Timestamp Field

This is 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.

5.2.7.5.3. Event Type Field

This indicates the type of event that took place on the door lock.

Value	Name
0	Operation
1	Programming
2	Alarm

5.2.7.5.4. Source Field

This is a source value where available sources are (see Operation Event Sources).

Value	Name
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).

5.2.7.5.5. Event ID Field

This indicates 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. See Operation Event Codes.

5.2.7.5.6. User ID Field

This indicates the ID of the user who generated the event on the door lock if one is available. Otherwise, the value is 0xFFFF.

5.2.7.5.7. PIN Field

This is a string indicating the PIN code or RFID code that was used to create the event on the door lock if one is available.

5.2.7.6. Set PIN Code Command

Set a PIN Code 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	**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	Summary
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.

5.2.7.7. Get PIN Code Command

Retrieve a PIN Code. User ID is between 0 - [# of PIN Users Supported attribute].

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**User ID**	uint16	desc			M

5.2.7.8. Get PIN Code Response Command

Returns the PIN for the specified user ID.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**User ID**	uint16	desc			M
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.

5.2.7.9. Clear PIN Code Command

Clear a PIN code or all PIN codes.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**PINSlotIndex** **User ID†**	uint16	1 to NumberOfPINUsersSupported, 0xFFFE			M

† 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 cor-

responding user record's UserStatus value SHALL be set to Available, and UserType value SHALL be set to UnrestrictedUser and all schedules SHALL be cleared.

5.2.7.9.1. PINSlotIndex

Specifies a valid PIN code slot index or 0xFFFE to indicate all PIN code slots SHALL be cleared.

5.2.7.10. 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.

5.2.7.11. 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

5.2.7.12. Get User Status Command

Get the status of a user.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**User ID**	uint16	desc			M

5.2.7.13. 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

5.2.7.14. Set Week Day Schedule Command

Set a weekly repeating schedule for a specified user.

Id	Name	Type	Constraint	Quality	Default	Conformance
0	**WeekDayIndex** **Schedule ID†**	uint8	1 to NumberOfWeekDaySchedulesSupportedPerUser			M
1	**UserIndex** **User ID†**	uint16	1 to NumberOfTotalUsersSupported			M
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	Summary
SUCCESS	Setting Week Day schedule was successful.
FAILURE	Some unexpected internal error occurred setting Week Day schedule.
INVALID_COMMAND	One or more fields violates constraints or is invalid. 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).

5.2.7.14.1. StartHour

This indicates the starting hour for the Week Day schedule.

5.2.7.14.2. StartMinute

This indicates the starting minute for the Week Day schedule.

5.2.7.14.3. EndHour

The ending hour for the Week Day schedule. EndHour SHALL be equal to or greater than StartHour.

5.2.7.14.4. 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.

5.2.7.15. Get Week Day Schedule Command

Retrieve the specific weekly schedule for the specific user.

ID	Field	Type	Constraint	Quality	Default	Conformance
0	**WeekDayIndex** **Schedule ID†**	uint8	1 to NumberOfWeekDaySchedulesSupportedPerUser			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.

5.2.7.16. Get Week Day Schedule Response Command

Returns the weekly repeating schedule data for the specified schedule index.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**WeekDayIndex** **Schedule ID†**	uint8	1 to NumberOfWeekDaySchedulesSupportedPerUser			M
1	**UserIndex** **User ID†**	uint16	1 to NumberOfTotalUsersSupported			M
2	**Status**	enum8	desc		SUCCESS	M

ID	Name	Type	Constraint	Quality	Default	Confor-mance
3	**DaysMask**	DaysMaskMap				O
4	**StartHour**	uint8	0 to 23			O
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 UserIndex instead, respectively.

5.2.7.16.1. Status

Status SHALL be one of the following values:

- SUCCESS if both WeekDayIndex and UserIndex are valid and there is a corresponding schedule entry.
- INVALID_COMMAND if either WeekDayIndex and/or UserIndex values are not within valid range
- NOT_FOUND if no corresponding schedule entry found for WeekDayIndex.
- NOT_FOUND if no corresponding user entry found for UserIndex.

If this field is SUCCESS, the optional fields for this command SHALL be present. For other (error) status values, only the fields up to the status field SHALL be present.

5.2.7.16.2. StartHour

This indicates the starting hour for the Week Day schedule.

5.2.7.16.3. StartMinute

This indicates the starting minute for the Week Day schedule.

5.2.7.16.4. EndHour

This indicates the ending hour for the Week Day schedule. EndHour SHALL be equal to or greater than StartHour.

5.2.7.16.5. EndMinute

The ending minute for the Week Day schedule. If EndHour is equal to StartHour then EndMinute SHALL be greater than StartMinute.

5.2.7.17. 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	Summary
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.

5.2.7.17.1. WeekDayIndex

The Week Day schedule index to clear or 0xFE to clear all Week Day schedules for the specified user.

5.2.7.18. 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	**LocalStartTime**	epoch-s	all			M
3	**LocalEndTime**	epoch-s	all			M

† The Schedule ID and User ID are obsolete field names, use YearDayIndex and UserIndex 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	Summary
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.

5.2.7.18.1. 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.

5.2.7.18.2. 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.

5.2.7.19. 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** **Schedule ID†**	uint8	1 to NumberOfYearDaySchedulesSupportedPerUser			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.

5.2.7.20. 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 NumberOfYearDaySchedulesSupportedPerUser			M
1	**UserIndex** **User ID†**	uint16	1 to NumberOfTotalUsersSupported			M
2	**Status**	enum8	desc		SUCCESS	M
2	**LocalStartTime**	epoch-s	all			O
3	**LocalEndTime**	epoch-s	all			O

† The Schedule ID and User ID are obsolete field names, use YearDayIndex and UserIndex instead, respectively.

5.2.7.20.1. 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 no corresponding schedule entry found for YearDayIndex.
- NOT_FOUND if no corresponding user entry found for UserIndex.

If this field is SUCCESS, the optional fields for this command SHALL be present. For other (error)

status values, only the fields up to the status field SHALL be present.

5.2.7.20.2. 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.

5.2.7.20.3. 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.

5.2.7.21. 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 NumberOfYearDaySchedulesSupportedPerUser, 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	Summary
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.

5.2.7.21.1. YearDayIndex

The Year Day schedule index to clear or 0xFE to clear all Year Day schedules for the specified user.

5.2.7.22. 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 NumberOfHolidaySchedulesSupported			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	Summary
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.

5.2.7.22.1. 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.

5.2.7.22.2. 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.

5.2.7.22.3. OperatingMode

The operating mode to use during this Holiday schedule start/end time.

5.2.7.23. 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.

5.2.7.24. 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	**OperatingMode**	OperatingModeEnum	all	X		O

† The Holiday Schedule ID is an obsolete field name, use HolidayIndex instead.

5.2.7.24.1. 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.

If this field is SUCCESS, the optional fields for this command SHALL be present. For other (error) status values, only the fields up to the status field SHALL be present.

5.2.7.24.2. 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.

5.2.7.24.3. 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.

5.2.7.24.4. 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.

5.2.7.25. Clear Holiday Schedule Command

Clears the holiday schedule or all holiday schedules.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**HolidayIndex** **Holiday Schedule ID†**	uint8	1 to NumberOfHolidaySchedulesSupported, 0xFE			M

† The Holiday Schedule ID is an obsolete field name, use HolidayIndex instead.

5.2.7.25.1. HolidayIndex

The Holiday schedule index to clear or 0xFE to clear all Holiday schedules.

5.2.7.26. 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

Id	Field	Type	Constraint	Quality	Default	Conformance
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	Summary
SUCCESS	Setting User Type was successful.
FAILURE	Some unexpected internal error occurred setting User Type.
INVALID_COMMAND	One or more fields violates constraints or is invalid. Door lock is unable to switch from restricted to unrestricted user (e.g. need to clear schedules to switch).

5.2.7.27. 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

5.2.7.28. 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

5.2.7.29. 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	Summary
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.

5.2.7.30. 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

5.2.7.31. 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.

5.2.7.32. Clear RFID Code Command

Clear an RFID code or all RFID codes.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**RFIDSlotIndex** **User ID†**	uint16	1 to NumberOfRFIDUsersSupported, 0xFFFE			M

† The User ID is an obsolete field name, use RFIDSlotIndex 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.

5.2.7.32.1. RFIDSlotIndex

Specifies a valid RFID code slot index or 0xFFFE to indicate all RFID code slots SHALL be cleared.

5.2.7.33. 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.

5.2.7.34. Set User Command

Set User into the lock.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**OperationType**	DataOperationTypeEnum	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	**CredentialRule**	CredentialRuleEnum		X	Single	M

Fields used for different use cases:

Use Case	Description
Create a new user record	• 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. CreatorFabricIndex and LastModifiedFabricIndex in the new user record SHALL be set to the accessing fabric index. A LockUserChange event SHALL be generated after successfully creating a new user.

Use Case	Description
Modify an existing user record	• 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. CreatorFabricIndex SHALL NOT be changed in the user record. LastModifiedFabricIndex in the new user record SHALL be set to the accessing fabric index. A LockUserChange event SHALL be generated after successfully modifying a user.

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.

5.2.7.34.1. 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.

5.2.7.34.2. 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.

5.2.7.34.3. 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.

5.2.7.34.4. 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.

5.2.7.34.5. 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.

5.2.7.35. 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.

5.2.7.36. 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	**CredentialRule**	CredentialRuleEnum	desc	X	Single	M
6	**Credentials**	list[CredentialStruct]	0 to NumberOfCredentialsSupportedPerUser	X		M
7	**CreatorFabricIndex**	fabric-idx	all	X		M
8	**LastModifiedFabricIndex**	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.

5.2.7.36.1. 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.

5.2.7.36.2. 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.

5.2.7.36.3. 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.

5.2.7.37. Clear User Command

Clears a User or all Users.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**UserIndex**	uint16	1 to NumberOfTotalUsersSupported, 0xFFFE			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.

5.2.7.37.1. UserIndex

Specifies a valid User index or 0xFFFE to indicate all User slots SHALL be cleared.

5.2.7.38. 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
1	**Operation Event Code**	uint8	desc			M
2	**User ID**	uint16	desc			M

Id	Field	Type	Constraint	Quality	Default	Conformance
3	**PIN**	octstr				M
4	**LocalTime**	epoch-s	all			M
5	**Data**	string				O

5.2.7.38.1. Operation Event Sources

This field indicates where the event was triggered from.

Value	Source
0	Keypad
1	Remote
2	Manual
3	RFID
0xFF	Indeterminate

5.2.7.38.2. 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
4	**LockFailureInvalidSchedule**	O	A	A		A

Value	Name	Conformance	Applicable			
5	**UnlockFailureInvalidPINorRFID**	O	A	A		A
6	**UnlockFailureInvalidSchedule**	O	A	A		A
7	**OneTouchLock**	O			A	
8	**KeyLock**	O			A	
9	**KeyUnlock**	O			A	
10	**AutoLock**	O			A	
11	**ScheduleLock**	WDSCH|YDSCH			A	
12	**ScheduleUnlock**	WDSCH|YDSCH			A	
13	**Manual Lock (Key or Thumbturn)**	O			A	
14	**Manual Unlock (Key or Thumbturn)**	O			A	
15	**Non-access User Operation Event**	O	A			

5.2.7.38.3. User ID

The User ID who performed the event.

5.2.7.38.4. PIN

The PIN that is associated with the User ID who performed the event.

5.2.7.38.5. 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.

5.2.7.38.6. 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.

5.2.7.38.7. Keypad Operation Event Notification

Keypad Operation Event Notification feature is enabled by setting the associated bitmasks in the [Keypad Operation Event Mask attribute].

5.2.7.38.8. Remote Operation Event Notification

Remote Operation Event Notification feature is enabled by setting the associated bitmasks in the [Remote Operation Event Mask attribute].

5.2.7.38.9. Manual Operation Event Notification

Manual Operation Event Notification feature is enabled by setting the associated bitmasks in the [Manual Operation Event Mask attribute] attribute.

5.2.7.38.10. RFID Operation Event Notification

RFID Operation Event Notification feature is enabled by setting the associated bitmasks in the [RFID Operation Event Mask attribute].

5.2.7.39. 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	Conformance
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
5	**User Status**	enum8	desc			M

Id	Field	Type	Constraint	Quality	Default	Conformance
6	**LocalTime**	epoch-s	all			M
7	**Data**	string				O

5.2.7.39.1. 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

5.2.7.39.2. 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

5.2.7.39.3. User ID

The User ID who performed the event

5.2.7.39.4. PIN

The PIN that is associated with the User ID who performed the event

5.2.7.39.5. User Type

The User Type that is associated with the User ID who performed the event

5.2.7.39.6. User Status

The User Status that is associated with the User ID who performed the event

5.2.7.39.7. 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.

5.2.7.39.8. 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.

5.2.7.39.9. Keypad Programming Event Notification

Keypad Programming Event Notification feature is enabled by setting the associated bitmasks in the [Keypad Programming Event Mask attribute].

5.2.7.39.10. Remote Programming Event Notification

Remote Programming Event Notification feature is enabled by setting the associated bitmasks in the [Remote Programming Event Mask attribute].

5.2.7.39.11. RFID Programming Event Notification

RFID Programming Event Notification feature is enabled by setting the associated bitmasks in the [RFID Programming Event Mask attribute].

5.2.7.40. 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	Conformance
2	**CredentialData**	octstr	desc			M
3	**UserIndex**	uint16	1 to NumberOfTotalUsersSupported	X		M
4	**UserStatus**	UserStatusEnum	OccupiedEnabled, OccupiedDisabled	X	OccupiedEnabled	M
5	**UserType**	UserTypeEnum	UnrestrictedUser, ProgrammingUser, NonAccessUser, ForcedUser, DisposableUser, ExpiringUser, RemoteOnlyUser	X	UnrestrictedUser	M

Fields used for different use cases:

Use Case	Description
Create a new credential and a new user record	• 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. CreatorFabricIndex and LastModifiedFabricIndex in new user and credential records SHALL be set to the accessing fabric index. 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.

Use Case	Description
Add a new credential to existing user record	• 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. CreatorFabricIndex SHALL NOT be changed in the user record. LastModifiedFabricIndex in the user record SHALL be set to the accessing fabric index. CreatorFabricIndex and LastModifiedFabricIndex in the new credential record SHALL be set to the accessing fabric index. A LockUserChange event SHALL be generated after successfully adding a new credential.

Use Case	Description
Modify credential for an existing user record	• 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. CreatorFabricIndex SHALL NOT be changed in user and credential records. LastModifiedFabricIndex in user and credential records SHALL be set to the accessing fabric index. A LockUserChange event SHALL be generated after successfully modifying a credential.

Use Case	Description
Modify credential for a Programming User	• 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. CreatorFabricIndex SHALL NOT be changed in the credential record. LastModifiedFabricIndex in the credential record SHALL be set to the accessing fabric index. A LockUserChange event SHALL be generated after successfully modifying a ProgrammingUser PIN code.

5.2.7.40.1. OperationType

The set credential operation type requested.

5.2.7.40.2. Credential

A credential structure that contains the CredentialTypeEnum and the credential index (if applicable or 0 if not) to set.

5.2.7.40.3. 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.

5.2.7.40.4. 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.

5.2.7.40.5. 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.

5.2.7.40.6. 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.

5.2.7.41. 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

5.2.7.41.1. 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.

5.2.7.41.2. 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.

5.2.7.41.3. 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.

5.2.7.42. 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**	CredentialStruct				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.

5.2.7.42.1. Credential

A credential structure that contains the CredentialTypeEnum and the credential index (if applicable or 0 if not) to retrieve the status for.

5.2.7.43. 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	**CreatorFabricIndex**	fabric-idx	all	X		M
3	**LastModifiedFabricIndex**	fabric-idx	all	X		M

Id	Field	Type	Constraint	Quality	Default	Conformance
4	**NextCredentialIndex**	uint16	desc	X		O

5.2.7.43.1. CredentialExists

A boolean value indicating the requested credential type and index exists and is populated for a given user index.

5.2.7.43.2. UserIndex

The credential's corresponding user index value if the credential exists. If CredentialType requested was ProgrammingPIN 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.

5.2.7.43.3. 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.

5.2.7.43.4. 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.

5.2.7.43.5. 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.

5.2.7.44. Clear Credential Command

Clear one, one type, or all credentials except ProgrammingPIN credential.

Id	Field	Type	Constraint	Quality	Default	Conformance
0	**Credential**	CredentialStruct	desc	X		M

Fields used for different use cases:

Use Case	Description
Clear a single credential	• 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. A LockUserChange event SHALL be generated after successfully clearing a credential.
Clear all credentials of one type	• 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 0xFFFE to indicate all credentials of that type SHALL be cleared. A single LockUserChange event SHALL be generated after successfully clearing credentials. This event SHALL have DataIndex set to the CredentialIndex in the Credential structure.
Clear all credentials of all types	• Credential field SHALL be null. The ProgrammingPIN credential SHALL NOT be cleared. For each credential type cleared, a LockUserChange event with the corresponding LockDataType SHALL be generated. This event SHALL have DataIndex set to 0xFFFE.

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	Summary
SUCCESS	Clearing credential(s) was successful.

Name	Summary
FAILURE	Some unexpected internal error occurred clearing credential(s).
INVALID_COMMAND	One or more fields violate constraints or are invalid.

5.2.7.44.1. Credential

A credential structure that contains the CredentialTypeEnum and the credential index (0xFFFE 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.

5.2.7.45. Unbolt Door Command

This command causes the lock device to unlock the door without pulling the latch. This command includes an optional code for the lock. The door lock MAY require a code depending on the value of the RequirePINForRemoteOperation 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]

5.2.7.45.1. PINCode Field

See PINCode Field.

5.2.8. 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.

5.2.8.1. 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**	AlarmCodeEnum	all			M

5.2.8.1.1. AlarmCode

The alarm code of the event that has happened.

5.2.8.2. 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

5.2.8.2.1. DoorState Field

The new door state for this door event.

5.2.8.3. 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
5	**Credentials**	list[CredentialStruct]	1 to NumberOfCredentialsSupportedPerUser	X		[USR]

- If the door lock server supports the Unbolt Door command, it SHALL generate a LockOperation event with LockOperationType set to Unlock after an Unbolt Door command succeeds.
- If the door lock server supports the Unbolting Feature and an Unlock Door command is performed, it SHALL generate a LockOperation event with LockOperationType set to Unlatch when the unlatched state is reached and a LockOperation event with LockOperationType set to Unlock when the lock successfully completes the unlock → hold latch → release latch and return to unlock state operation.
- If the command fails during holding or releasing the latch but after passing the unlocked state, the door lock server SHALL generate a LockOperationError event with LockOperationType set to Unlatch and a LockOperation event with LockOperationType set to Unlock.
  - If it fails before reaching the unlocked state, the door lock server SHALL generate only a LockOperationError event with LockOperationType set to Unlock.
- Upon manual actuation, a door lock server that supports the Unbolting Feature:
  - SHALL generate a LockOperation event of LockOperationType Unlatch when it is actuated from the outside.
  - MAY generate a LockOperation event of LockOperationType Unlatch when it is actuated from the inside.

5.2.8.3.1. LockOperationType

The type of the lock operation that was performed.

5.2.8.3.2. OperationSource

The source of the lock operation that was performed.

5.2.8.3.3. 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.

5.2.8.3.4. 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".

5.2.8.3.5. 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".

5.2.8.3.6. Credentials

The list of credentials used in performing the lock operation. This SHALL be null if no credentials were involved.

5.2.8.4. 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

Id	Field	Type	Constraint	Quality	Default	Conformance
6	**Credentials**	list[CredentialStruct]	1 to NumberOfCredentialsSupportedPerUser	X		[USR]

5.2.8.4.1. LockOperationType

The type of the lock operation that was performed.

5.2.8.4.2. OperationSource

The source of the lock operation that was performed.

5.2.8.4.3. OperationError

The lock operation error triggered when the operation was performed.

5.2.8.4.4. 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.

5.2.8.4.5. 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".

5.2.8.4.6. 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".

5.2.8.4.7. Credentials

The list of credentials used in performing the lock operation. This SHALL be null if no credentials were involved.

5.2.8.5. 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	**LockDataType**	LockDataTypeEnum	all			M
1	**DataOperationType**	DataOperationTypeEnum	all			M
2	**OperationSource**	OperationSourceEnum	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

5.2.8.5.1. LockDataType

The lock data type that was changed.

5.2.8.5.2. DataOperationType

The data operation performed on the lock data type changed.

5.2.8.5.3. OperationSource

The source of the user data change.

5.2.8.5.4. 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 0xFFFE if all users are affected (e.g. Clear Users).

5.2.8.5.5. 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".

5.2.8.5.6. SourceNode

The Node ID that 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".

5.2.8.5.7. 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 0xFFFE if all indices are affected (e.g. Clear PIN Code, Clear RFID Code, Clear Week Day Schedule, Clear Year Day Schedule, etc.).

5.2.9. Data Types

5.2.9.1. 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	Summary
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	FrontEsceutcheonRe-moved	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

5.2.9.2. 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	Summary
0	**Single**	USR	Only one credential is required for lock oper-ation
1	**Dual**	[USR]	Any two credentials are required for lock oper-ation

Value	Name	Conformance	Summary
2	**Tri**	[USR]	Any three credentials are required for lock operation

5.2.9.3. 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	**CredentialType**	CredentialTypeEnum	all			M
1	**CredentialIndex**	uint16	all		0	M

5.2.9.3.1. CredentialType

The credential type used to authorize the lock operation.

5.2.9.3.2. 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.

5.2.9.4. 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	Summary
0	**ProgrammingPIN**	O	Programming PIN code credential type
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

Value	Name	Conformance	Summary
5	**Face**	FACE	Face identifier credential type

5.2.9.5. DataOperationTypeEnum

The DataOperationType enum SHALL indicate the data operation performed. The data type of the DataOperationType enum is derived from enum8.

Value	Name	Conformance	Summary
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

5.2.9.6. 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	Name	Conformance
0	Sunday	M
1	Monday	M
2	Tuesday	M
3	Wednesday	M
4	Thursday	M
5	Friday	M
6	Saturday	M

5.2.9.7. 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	Summary
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

Value	Name	Conformance	Summary
4	**DoorUnspecifiedError**	[DPS]	Door state is invalid for unspecified reason
5	**DoorAjar**	[DPS]	Door state is ajar

5.2.9.8. DoorLockStatus

The cluster-specific status codes for the Door Lock cluster are as follows:

Value	Status Code	Summary
2	**DUPLICATE**	Entry would cause a duplicate credential/ID.
3	**OCCUPIED**	Entry would replace an occupied slot.

5.2.9.8.1. DUPLICATE

The provided User ID, PIN or RFID code or other credential is a duplicate of an existing entry.

5.2.9.8.2. 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.

5.2.9.9. 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	Summary
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.
2	UserIndex	M	Lock user index was added, cleared, or modified.
3	WeekDaySchedule	WDSCH	Lock user week day schedule was added, cleared, or modified.

Value	Name	Conformance	Summary
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.

5.2.9.10. 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	Summary
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
3	**ForcedUserEvent**	O	Triggered by using a user with UserType set to Forced User
4	**Unlatch**	M	Unlatch operation

5.2.9.11. OperationErrorEnum

The OperationError enumeration SHALL indicate the error cause of the Lock/Unlock operation per-

formed. The data type of the OperationError enum field is derived from enum8.

Value	Name	Conformance	Summary
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

5.2.9.12. 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	Keypad*	Remote*	RFID*
0	**Normal**	M	Yes	Yes	Yes
1	**Vacation**	O	No	Yes	No
2	**Privacy**	O	No	No	No
3	**NoRemote-LockUnlock**	M	Yes	No	Yes
4	**Passage**	O	N/A	N/A	N/A

* Interface Operational: Yes, No or 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.

5.2.9.12.1. Normal

The lock operates normally. All interfaces are enabled.

5.2.9.12.2. Vacation

Only remote interaction is enabled. The keypad SHALL only be operable by the master user.

5.2.9.12.3. 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.

5.2.9.12.4. 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.

5.2.9.12.5. 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).

5.2.9.13. 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	Summary
0	**Unspecified**	O	Lock/unlock operation came from unspecified source
1	**Manual**	O	Lock/unlock operation came from manual operation (key, thumbturn, handle, etc).
2	**ProprietaryRemote**	O	Lock/unlock operation came from prioretary 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)

Value	Name	Conformance	Summary
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)

5.2.9.14. 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.

5.2.9.15. UserStatusEnum

The UserStatus enum used in various commands SHALL indicate what the status is for a specific user ID.

Value	Name	Conformance
0	**Available**	M
1	**OccupiedEnabled**	M
3	**OccupiedDisabled**	O

5.2.9.16. UserTypeEnum

The UserType enum used in various commands SHALL indicate what the type is for a specific user ID.

Value	Name	Conformance
0	**UnrestrictedUser**	M
1	**YearDayScheduleUser**	O
2	**WeekDayScheduleUser**	O

Value	Name	Conformance
3	**ProgrammingUser**	O
4	**NonAccessUser**	O
5	**ForcedUser**	[USR]
6	**DisposableUser**	[USR]
7	**ExpiringUser**	[USR]
8	**ScheduleRestrictedUser**	WDSCH|YDSCH
9	**RemoteOnlyUser**	USR & COTA & PIN

5.2.9.16.1. UnrestrictedUser

User has access 24/7 provided proper PIN or RFID is supplied (e.g., owner).

5.2.9.16.2. YearDayScheduleUser

User has ability to open lock within a specific time period (e.g., guest).

5.2.9.16.3. WeekDayScheduleUser

User has ability to open lock based on specific time period within a reoccurring weekly schedule (e.g., cleaning worker).

5.2.9.16.4. 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…).

5.2.9.16.5. 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.

5.2.9.16.6. 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.

5.2.9.16.7. DisposableUser

User has ability to open lock once after which the lock SHALL change the corresponding user record UserStatus value to OccupiedDisabled automatically.

5.2.9.16.8. 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 corre-

sponding 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.

5.2.9.16.9. ScheduleRestrictedUser

User access is restricted by Week Day and/or Year Day schedule.

5.2.9.16.10. 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 Cluster

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.

Revision	Description
1	Mandatory global ClusterRevision 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 PositionAware and AbsolutePosition features. General cleanup of functionality.

5.3.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	WNCV

5.3.3. Cluster ID

ID	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.

Due to backward compatibility reasons this feature map SHALL match the advertised Type Attribute Supported Features.

5.3.4.1. Lift Feature

The Lift feature applies to window coverings that lift up and down (e.g. for a roller shade, Up and Down is lift Open and Close) or slide left to right (e.g. for a sliding curtain, Left and Right is lift Open and Close).

5.3.4.2. Tilt Feature

The Tilt feature applies to window coverings with vertical or horizontal strips.

5.3.4.3. PositionAware Features

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 reflects 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. PositionAwareLift Feature

Relative positioning for lift attributes and commands.

5.3.4.3.2. PositionAwareTilt Feature

Relative positioning for tilt attributes and commands.

5.3.4.4. AbsolutePosition Feature

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. Data Types

5.3.5.1. ConfigStatusBitmap Type

This data type is derived from map8.

Bit	Name	Summary
0	**Operational**	Device is operational.
1	**OnlineReserved**	Deprecated and reserved.
2	**LiftMovementReversed**	The lift movement is reversed.
3	**LiftPositionAware**	Supports the PositionAwareLift feature (PA_LF).
4	**TiltPositionAware**	Supports the PositionAwareTilt feature (PA_TL).
5	**LiftEncoderControlled**	Uses an encoder for lift.
6	**TiltEncoderControlled**	Uses an encoder for tilt.

5.3.5.1.1. Operational Bit

This bit SHALL indicate whether the window covering is operational for regular use:

- 0 = Not Operational
- 1 = Operational

5.3.5.1.2. LiftMovementReversed Bit

This bit SHALL indicate whether the lift movement is reversed:

- 0 = Lift movement is normal
- 1 = Lift movement is reversed

5.3.5.1.3. LiftPositionAware Bit

This bit SHALL indicate whether the window covering supports the PositionAwareLift feature:

- 0 = Lift control is not position aware

- 1 = Lift control is position aware (PA_LF)

5.3.5.1.4. TiltPositionAware Bit

This bit SHALL indicate whether the window covering supports the PositionAwareTilt feature:

- 0 = Tilt control is not position aware
- 1 = Tilt control is position aware (PA_TL)

5.3.5.1.5. LiftEncoderControlled Bit

This bit SHALL indicate whether a position aware controlled window covering is employing an encoder for positioning the height of the window covering:

- 0 = Timer Controlled
- 1 = Encoder Controlled

5.3.5.1.6. TiltEncoderControlled Bit

This bit SHALL indicate whether a position aware controlled window covering is employing an encoder for tilting the window covering:

- 0 = Timer Controlled
- 1 = Encoder Controlled

5.3.5.2. ModeBitmap Type

This data type is derived from map8.

Bit	Name	Summary
0	**MotorDirectionReversed**	Reverse the lift direction.
1	**CalibrationMode**	Perform a calibration.
2	**MaintenanceMode**	Freeze all motions for maintenance.
3	**LedFeedback**	Control the LEDs feedback.

5.3.5.2.1. MotorDirectionReversed Bit

This bit SHALL control the motor direction:

- 0 = Lift movement is normal
- 1 = Lift movement is reversed

5.3.5.2.2. CalibrationMode Bit

This bit SHALL set the window covering into calibration mode:

- 0 = Normal mode

- 1 = Calibration mode

5.3.5.2.3. MaintenanceMode Bit

This bit SHALL set the window covering into maintenance mode:

- 0 = Normal mode
- 1 = Maintenance mode

5.3.5.2.4. LedFeedback Bit

This bit SHALL control feedback LEDs:

- 0 = LEDs are off
- 1 = LEDs will display feedback

5.3.5.3. OperationalStatusBitmap Type

This data type is derived from map8.

Bit	Name	Summary
0..1	**Global**	Global operational state.
2..3	**Lift**	Lift operational state.
4..5	**Tilt**	Tilt operational state.

The OperationalStatusBitmap is using several internal operational state fields (composed of 2 bits) following this definition:

- 00b = Currently not moving
- 01b = Currently opening (e.g. moving from closed to open).
- 10b = Currently closing (e.g. moving from open to closed).
- 11b = Reserved

5.3.5.3.1. Global Bits

These bits SHALL indicate in which direction the covering is currently moving or if it has stopped. Global operational state SHALL always reflect the overall motion of the device.

5.3.5.3.2. Lift Bits

These bits SHALL indicate in which direction the covering's lift is currently moving or if it has stopped.

5.3.5.3.3. Tilt Bits

These bits SHALL indicate in which direction the covering's tilt is currently moving or if it has stopped.

5.3.5.4. SafetyStatusBitmap

This data type is derived from map16.

Bit	Name	Summary
0	**RemoteLockout**	Movement commands are ignored (locked out). e.g. not granted authorization, outside some time/date range.
1	**TamperDetection**	Tampering detected on sensors or any other safety equipment. Ex: a device has been forcedly moved without its actuator(s).
2	**FailedCommunication**	Communication failure to sensors or other safety equipment.
3	**PositionFailure**	Device has failed to reach the desired position. e.g. with position aware device, time expired before TargetPosition is reached.
4	**ThermalProtection**	Motor(s) and/or electric circuit thermal protection activated.
5	**ObstacleDetected**	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	**StopInput**	Local safety sensor (not a direct obstacle) is preventing movements (e.g. Safety EU Standard EN60335).
8	**MotorJammed**	Mechanical problem related to the motor(s) detected.
9	**HardwareFailure**	PCB, fuse and other electrics problems.
10	**ManualOperation**	Actuator is manually operated and is preventing actuator movement (e.g. actuator is disengaged/decoupled).
11	**Protection**	Protection is activated.

5.3.5.5. TypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**RollerShade**	RollerShade	LF
1	**RollerShade2Motor**	RollerShade - 2 Motor	LF
2	**RollerShadeExterior**	RollerShade - Exterior	LF
3	**RollerShadeExterior2-Motor**	RollerShade - Exterior - 2 Motor	LF
4	**Drapery**	Drapery (curtain)	LF
5	**Awning**	Awning	LF
6	**Shutter**	Shutter	LF | TL
7	**TiltBlindTiltOnly**	Tilt Blind - Tilt Only	TL
8	**TiltBlindLiftAndTilt**	Tilt Blind - Lift & Tilt	LF & TL
9	**ProjectorScreen**	Projector Screen	LF
255	**Unknown**	Unknown	O

5.3.5.6. EndProductTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**RollerShade**	Simple Roller Shade	LF
1	**RomanShade**	Roman Shade	LF
2	**BalloonShade**	Balloon Shade	LF
3	**WovenWood**	Woven Wood	LF
4	**PleatedShade**	Pleated Shade	LF
5	**CellularShade**	Cellular Shade	LF
6	**LayeredShade**	Layered Shade	LF
7	**LayeredShade2D**	Layered Shade 2D	LF
8	**SheerShade**	Sheer Shade	LF & TL
9	**TiltOnlyInteriorBlind**	Tilt Only Interior Blind	TL
10	**InteriorBlind**	Interior Blind	LF & TL
11	**VerticalBlindStripCur-tain**	Vertical Blind, Strip Curtain	LF & TL
12	**InteriorVenetianBlind**	Interior Venetian Blind	LF & TL

Value	Name	Summary	Conformance
13	**ExteriorVenetian-Blind**	Exterior Venetian Blind	LF & TL
14	**LateralLeftCurtain**	Lateral Left Curtain	LF
15	**LateralRightCurtain**	Lateral Right Curtain	LF
16	**CentralCurtain**	Central Curtain	LF
17	**RollerShutter**	Roller Shutter	LF
18	**ExteriorVerti-calScreen**	Exterior Vertical Screen	LF
19	**AwningTerracePatio**	Awning Terrace (Patio)	LF
20	**AwningVerticalScreen**	Awning Vertical Screen	LF
21	**TiltOnlyPergola**	Tilt Only Pergola	LF | TL
22	**SwingingShutter**	Swinging Shutter	LF | TL
23	**SlidingShutter**	Sliding Shutter	LF | TL
255	**Unknown**	Unknown	O

5.3.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Confor-mance
0x0000	**Type**	TypeEnum	desc	F	0	R V	M
0x0001	**Physical-Clos-edLim-itLift**	uint16	all	F	0	R V	[LF & PA_LF & ABS]
0x0002	**Physical-Clos-edLimit-Tilt**	uint16	all	F	0	R V	[TL & PA_TL & ABS]
0x0003	**Current-Position-Lift**[1]	uint16	Installe-dOpenLim-itLift to Installed-ClosedLim-itLift	XN	null	R V	[LF & PA_LF & ABS]

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0004	**CurrentPositionTilt**[1]	uint16	InstalledOpenLimitTilt to InstalledClosedLimitTilt	XN	null	R V	[TL & PA_TL & ABS]
0x0005	**NumberOfActuationsLift**	uint16	all	N	0	R V	[LF]
0x0006	**NumberOfActuationsTilt**	uint16	all	N	0	R V	[TL]
0x0007	**ConfigStatus**	ConfigStatusBitmap	desc	N	desc	R V	M
0x0008	**CurrentPositionLiftPercentage**[1]	percent		XNSP	null	R V	[LF & PA_LF]
0x0009	**CurrentPositionTiltPercentage**[1]	percent	0 to 100	XNSP	null	R V	[TL & PA_TL]
0x000A	**OperationalStatus**	OperationalStatusBitmap	0b00xxxxxx	P	0	R V	M
0x000B	**TargetPositionLiftPercent100ths**[2]	percent100ths		XSP	null	R V	LF & PA_LF
0x000C	**TargetPositionTiltPercent100ths**[2]	percent100ths		XSP	null	R V	TL & PA_TL
0x000D	**EndProductType**	EndProductTypeEnum	desc	F	0	R V	M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x000E	**CurrentPositionLiftPercent100ths**[1]	percent100ths	0 to 10000	XNP	null	R V	LF & PA_LF
0x000F	**CurrentPositionTiltPercent100ths**[1]	percent100ths	0 to 10000	XNP	null	R V	TL & PA_TL
0x0010	**InstalledOpenLimitLift**	uint16	0 to 65534	N	0	R V	LF & PA_LF & ABS
0x0011	**InstalledClosedLimitLift**	uint16	0 to 65534	N	65534	R V	LF & PA_LF & ABS
0x0012	**InstalledOpenLimitTilt**	uint16	0 to 65534	N	0	R V	TL & PA_TL & ABS
0x0013	**InstalledClosedLimitTilt**	uint16	0 to 65534	N	65534	R V	TL & PA_TL & ABS
0x0014	**VelocityLift**						D
0x0015	**AccelerationTimeLift**						D
0x0016	**DecelerationTimeLift**						D
0x0017	**Mode**	ModeBitmap	0b0000xxxx	N	0	RW VM	M
0x0018	**IntermediateSetpointsLift**						D
0x0019	**IntermediateSetpointsTilt**						D

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x001A	**SafetyStatus**	SafetyStatusBitmap	desc	P	0	R V	O

NOTE

Nullable positions

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.

5.3.6.1. Scene Table Extensions

If the Scenes server cluster is implemented on the same endpoint, the following attributes SHALL be part of the ExtensionFieldSetStruct of the Scene Table. If the implicit form of the ExtensionFieldSetStruct is used, the order of the attributes in the AttributeValueList is in the given order, i.e., the attribute listed as 1 is added first:

1. CurrentPositionLiftPercentage
2. CurrentPositionTiltPercentage
3. TargetPositionLiftPercent100ths
4. 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.

5.3.6.2. Type Attribute

This attribute SHALL identify the type of window covering.

5.3.6.3. PhysicalClosedLimitLift Attribute

This attribute SHALL indicate the maximum possible encoder position possible (Unit *cm*, centimeters) to position the height of the window covering lift.

5.3.6.4. PhysicalClosedLimitTilt Attribute

This attribute SHALL indicate the maximum possible encoder position possible (Unit *0.1°*, tenths of a degree) to position the angle of the window covering tilt.

5.3.6.5. CurrentPositionLift Attribute

This attribute SHALL indicate the actual lift position (Unit *cm*, centimeters) of the window covering from the fully-open position.

5.3.6.6. CurrentPositionTilt Attribute

This attribute SHALL indicate the actual tilt position (Unit *0.1°*, tenths of a degree) of the window covering from the fully-open position.

5.3.6.7. NumberOfActuationsLift Attribute

This attribute SHALL indicate the total number of lift/slide actuations applied to the window covering since the device was installed.

5.3.6.8. NumberOfActuationsTilt Attribute

This attribute SHALL indicate the total number of tilt actuations applied to the window covering since the device was installed.

5.3.6.9. ConfigStatus Attribute

This attribute specifies the configuration and status information of the window covering.

To change settings, devices SHALL write to the Mode attribute. The behavior causing the setting or clearing of each bit is vendor specific.

5.3.6.9.1. Operational Bit

The SafetyStatus & Mode attributes might affect this bit state.

5.3.6.9.2. LiftMovementReversed Bit

This 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 MotorDirectionReversed bit in the Mode attribute.

5.3.6.9.3. LiftEncoderControlled Bit

This bit is ignored if the device does not support the PositionAwareLift feature (PA_LF).

5.3.6.9.4. TiltEncoderControlled Bit

This bit is ignored if the device does not support the PositionAwareTilt feature (PA_TL).

5.3.6.10. CurrentPositionLiftPercent100ths Attribute

This attribute SHALL indicate the actual position as a percentage with a minimal step of 0.01%. E.g Max 10000 equals 100.00%.

5.3.6.11. CurrentPositionTiltPercent100ths Attribute

This attribute SHALL indicate the actual position as a percentage with a minimal step of 0.01%. E.g Max 10000 equals 100.00%.

5.3.6.12. CurrentPositionLiftPercentage Attribute

This attribute SHALL indicate the actual position as a percentage from 0% to 100% with 1% default step. This attribute is equal to CurrentPositionLiftPercent100ths attribute divided by 100.

5.3.6.13. CurrentPositionTiltPercentage Attribute

This attribute SHALL indicate the actual position as a percentage from 0% to 100% with 1% default step. This attribute is equal to CurrentPositionTiltPercent100ths attribute divided by 100.

5.3.6.14. TargetPositionLiftPercent100ths Attribute

This attribute SHALL indicate the position where the window covering lift will go or is moving to as a percentage (Unit *0.01%*).

5.3.6.15. TargetPositionTiltPercent100ths Attribute

This attribute SHALL indicate the position where the window covering tilt will go or is moving to as a percentage (Unit *0.01%*).

5.3.6.16. OperationalStatus Attribute

This attribute SHALL indicate the currently ongoing operations and applies to all type of devices.

5.3.6.17. EndProductType Attribute

This attribute SHOULD provide more detail about the product type than can be determined from the main category indicated by the Type attribute.

The table below helps to match the EndProductType attribute with the Type attribute.

Value	Name	Indoor Outdoor	Indicative Dimension	Recommended Type Attribute
0	**RollerShade**	I	1D	RollerShade
1	**RomanShade**	I	1D	RollerShade
2	**BalloonShade**	I	1D	RollerShade

Value	Name	Indoor Outdoor	Indicative Dimension	Recommended Type Attribute
3	**WovenWood**	I	1D	RollerShade
4	**PleatedShade**	I	1D	RollerShade
5	**CellularShade**	I	1D	RollerShade
6	**LayeredShade**	I	1D	RollerShade
7	**LayeredShade2D**	I	2D	RollerShade2Motor
8	**SheerShade**	I	2D	TiltBlindLiftAndTilt
9	**TiltOnlyInteriorBlind**	I	1D	TiltBlindTiltOnly
10	**InteriorBlind**	I	2D	TiltBlindLiftAndTilt
11	**VerticalBlindStripCurtain**	I	2D	TiltBlindLiftAndTilt
12	**InteriorVenetianBlind**	I	2D	TiltBlindLiftAndTilt
13	**ExteriorVenetianBlind**	O	2D	TiltBlindLiftAndTilt
14	**LateralLeftCurtain**	I	1D	Drapery
15	**LateralRightCurtain**	I	1D	Drapery
16	**CentralCurtain**	I	1D	Drapery
17	**RollerShutter**	O	1D	RollerShadeExterior
18	**ExteriorVerticalScreen**	O	1D	RollerShadeExterior
19	**AwningTerracePatio**	O	1D	Awning
20	**AwningVerticalScreen**	O	1D	Awning
21	**TiltOnlyPergola**	O	1D	Shutter
22	**SwingingShutter**	O	1D	Shutter
23	**SlidingShutter**	O	1D	Shutter
255	**Unknown**			Unknown

5.3.6.18. InstalledOpenLimitLift Attribute

This attribute SHALL indicate the open limit for lifting the window covering whether position (in centimeters) is encoded or timed.

5.3.6.19. InstalledClosedLimitLift Attribute

This attribute SHALL indicate the closed limit for lifting the window covering whether position (in centimeters) is encoded or timed.

5.3.6.20. InstalledOpenLimitTilt Attribute

This attribute SHALL indicate the open limit for tilting the window covering whether position (in tenth of a degree) is encoded or timed.

5.3.6.21. InstalledClosedLimitTilt Attribute

This attribute SHALL indicate the closed limit for tilting the window covering whether position (in tenth of a degree) is encoded or timed.

5.3.6.22. 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.

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.

5.3.6.22.1. MotorDirectionReversed Bit

This bit SHALL control the LiftMovementReversed Bit bit in the ConfigStatus Attribute attribute.

5.3.6.22.2. CalibrationMode Bit

If in calibration mode, all commands (e.g: UpOrOpen, DownOrClose, GoTos) 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.

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.

A manufacturer might choose to set the Operational Bit bit of the ConfigStatus Attribute attribute to

its not operational value, if applicable during calibration mode.

5.3.6.22.3. MaintenanceMode Bit

While in maintenance mode, all commands (e.g: UpOrOpen, DownOrClose, GoTos) or local inputs that can result in movement, must be ignored and respond with a BUSY status. Additionally, the Operational Bit bit of the ConfigStatus Attribute attribute should be set to its not operational value.

5.3.6.23. 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).

5.3.7. 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]
0x07	**GoToTiltValue**	client ⇒ server	Y	O	[TL & ABS]
0x08	**GoToTiltPercentage**	client ⇒ server	Y	O	TL & PA_TL, [TL]

5.3.7.1. 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 the PositionAware 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 the PositionAware 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 the AbsolutePosition feature is supported:

- CurrentPositionLift attribute SHALL be equal to the InstalledOpenLimitLift attribute.
- CurrentPositionTilt attribute SHALL be equal to the InstalledOpenLimitTilt attribute.

5.3.7.2. 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 the PositionAware 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 the PositionAware 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 the AbsolutePosition feature is supported:

- CurrentPositionLift attribute SHALL be equal to the InstalledClosedLimitLift attribute.
- CurrentPositionTilt attribute SHALL be equal to the InstalledClosedLimitTilt attribute.

5.3.7.3. StopMotion Command

Upon receipt of this command, the window covering will stop any adjusting to the physical tilt and lift/slide 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.

5.3.7.4. GoToLiftValue Command

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**LiftValue**	uint16	desc			M

5.3.7.4.1. LiftValue Field

This field SHALL specify the requested physical lift/slide position in unit cm (centimeters).

5.3.7.4.2. Effect on Receipt

Upon receipt of this command, the window covering will adjust the lift position to the value specified in the LiftValue field, as long as that value is not larger thanInstalledOpenLimitLift attribute and not smaller than InstalledClosedLimitLift attribute. The TargetPositionLiftPercent100ths attribute SHALL update its value accordingly.

If the value is out of bounds a response containing the status of CONSTRAINT_ERROR will be returned.

5.3.7.5. GoToLiftPercentage Command

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**LiftPercentageValue**	percent	desc			O.a
1	**LiftPercent100thsValue**	percent100ths	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 PositionAware 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.

5.3.7.6. GoToTiltValue Command

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**TiltValue**	uint16	desc			M

5.3.7.6.1. TiltValue

This field SHALL specify the requested physical tilt position in unit *0.1°* (tenth of a degrees).

5.3.7.6.2. Effect on Receipt

Upon receipt of this command, the window covering will adjust the tilt position to the value specified in the TiltValue field, as long as that value is not larger than InstalledOpenLimitTilt attribute and not smaller than InstalledClosedLimitTilt attribute. The TargetPositionTiltPercent100ths attribute SHALL update its value accordingly.

If the tilt value is out of bounds a response containing the status of CONSTRAINT_ERROR will be returned.

5.3.7.7. GoToTiltPercentage Command

This command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**TiltPercentageValue**	percent	desc			O.a
1	**TiltPercent100thsValue**	percent100ths	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 PositionAware 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.

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

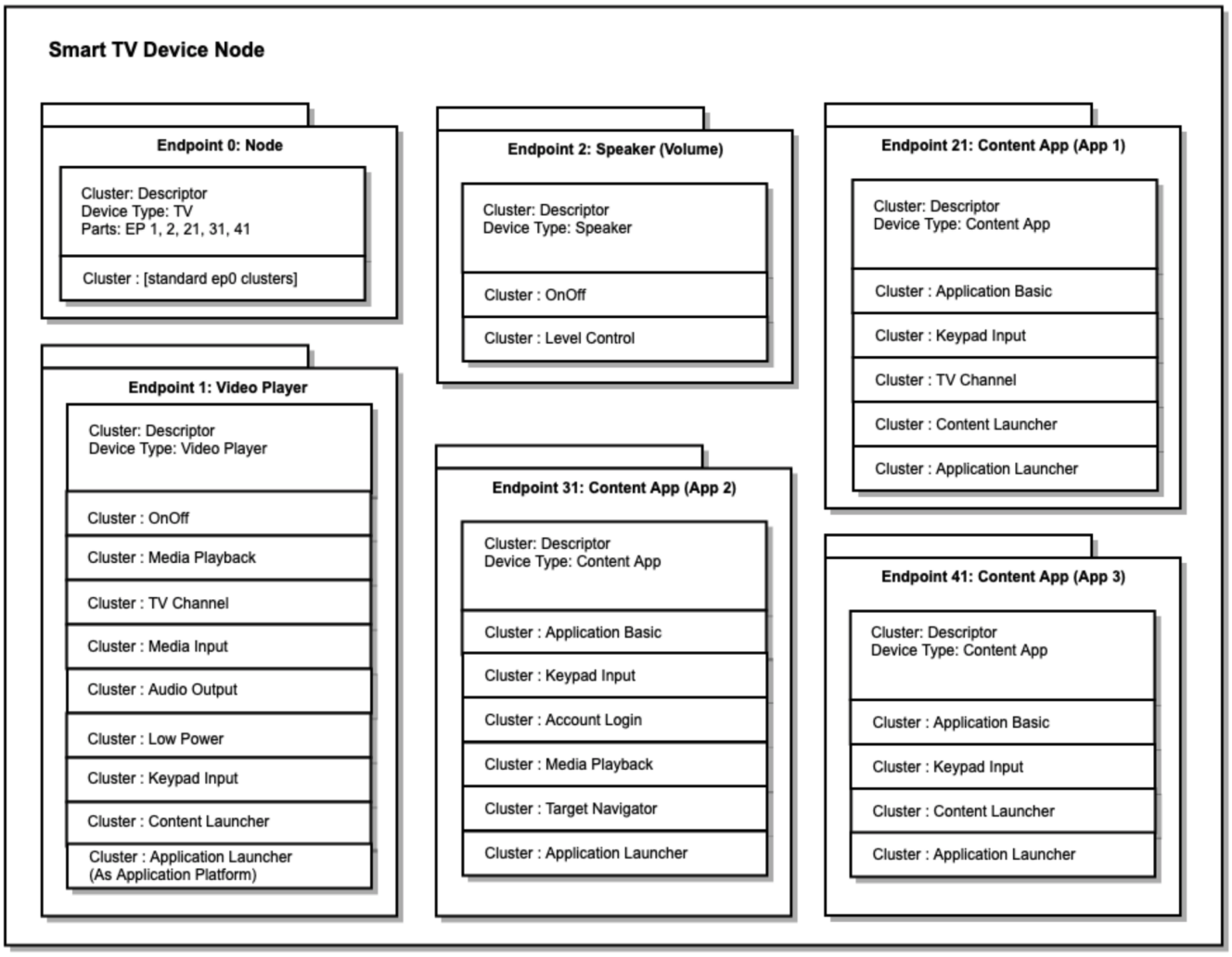
This section lists the media specific clusters as specified in this chapter.

Table 38. Overview of the Media Clusters

Cluster 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.

Cluster 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.

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. Revision History

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

Revision	Description
1	Initial Release

6.2.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	ALOGIN

6.2.3. Cluster ID

ID	Name
0x050E	Account Login

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 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	Name	Type	Constraint	Quality	Default	Conformance
0	**TempAccountIdentifier**	string	16 to 100			M

6.2.4.1.1. TempAccountIdentifier Field

This field 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	Name	Type	Constraint	Quality	Default	Conformance
0	**SetupPIN**	string	min 11	X		M

6.2.4.2.1. SetupPIN Field

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 corresponding 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 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	Name	Type	Constraint	Quality	Default	Conformance
0	**TempAccountIdentifier**	string	16 to 100			M
1	**SetupPIN**	string	min 11			M

6.2.4.3.1. TempAccountIdentifier Field

This field SHALL specify the client's temporary account identifier.

6.2.4.3.2. SetupPIN Field

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).

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. Revision History

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

Revision	Description
1	Initial Release

6.3.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	APBSC

6.3.3. Cluster ID

ID	Name
0x050D	Application Basic

6.3.4. Data Types

6.3.4.1. ApplicationStatusEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Stopped**	Application is not running.	M
1	**ActiveVisibleFocus**	Application is running, is visible to the user, and is the active target for input.	M
2	**ActiveHidden**	Application is running but not visible to the user.	M
3	**ActiveVisibleNotFocus**	Application is running and visible, but is not the active target for input.	M

6.3.4.2. ApplicationStruct Type

This indicates a global identifier for an Application given a catalog.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**CatalogVendorID**	uint16	all				M
1	**ApplicationID**	string	all				M

6.3.4.2.1. CatalogVendorID Field

This field 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.

6.3.4.2.2. ApplicationID Field

This field 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.

6.3.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**VendorName**	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
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	**AllowedVendorList**	list[vendor-id]		F		R A	M

6.3.5.1. VendorName Attribute

This attribute SHALL specify a human readable (displayable) name of the vendor for the Content App.

6.3.5.2. VendorID Attribute

This attribute, if present, SHALL specify the Connectivity Standards Alliance assigned Vendor ID for the Content App.

6.3.5.3. 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.

6.3.5.4. 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.

6.3.5.5. Application Attribute

This attribute SHALL specify a Content App which consists of an Application ID using a specified catalog.

6.3.5.6. Status Attribute

This attribute SHALL specify the current running status of the application.

6.3.5.7. 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 characters.

6.3.5.8. AllowedVendorList Attribute

This attribute is a list of vendor IDs. Each entry is a vendor-id.

6.4. Application Launcher Cluster

This cluster provides an interface for launching applications on a Video Player device such as a TV.

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 fea-

ture not supported) or it can support launching any application (AP feature supported).

6.4.1. Revision History

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

Revision	Description
1	Initial Release

6.4.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	APPLAUNCHER

6.4.3. Cluster ID

ID	Name
0x050C	Application Launcher

6.4.4. Features

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

Bit	Code	Feature	Summary
0	**AP**	ApplicationPlatform	Support for attributes and commands required for endpoint to support launching any application within the supported application catalogs

6.4.5. Data Types

6.4.5.1. StatusEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Success**	Command succeeded	M
1	**AppNotAvailable**	Requested app is not available.	M

Value	Name	Summary	Conformance
2	**SystemBusy**	Video platform unable to honor command.	M

6.4.5.2. ApplicationStruct Type

This indicates a global identifier for an Application given a catalog.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**CatalogVendorID**	uint16	all				M
1	**ApplicationID**	string	all				M

6.4.5.2.1. CatalogVendorID Field

This field 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 Field

This field 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 Type

This specifies an app along with its corresponding endpoint.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Application**	ApplicationStruct	all				M
1	**Endpoint**	endpoint-no	all		MS		O

6.4.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**CatalogList**	list[uint16]		N		R V	AP
0x0001	**CurrentApp**	ApplicationEPStruct	desc	X	null	R V	O

6.4.6.1. 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.

6.4.6.2. 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.

6.4.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**LaunchApp**	Client ⇒ Server	LauncherResponse	O	M
0x01	**StopApp**	Client ⇒ Server	LauncherResponse	O	M
0x02	**HideApp**	Client ⇒ Server	LauncherResponse	O	M
0x03	**LauncherResponse**	Server ⇒ Client	N		M

6.4.7.1. 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 ActiveVisibleFocus 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	Name	Type	Constraint	Quality	Default	Conformance
0	**Application**	Application-Struct	desc			AP
1	**Data**	octstr			MS	O

6.4.7.1.1. Application Field

This field SHALL specify the Application to launch.

6.4.7.1.2. Data Field

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.

6.4.7.2. 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	Name	Type	Constraint	Quality	Default	Conformance
0	**Application**	Application-Struct	desc		MS	AP

6.4.7.2.1. Application Field

This field SHALL specify the Application to stop.

6.4.7.3. 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 ActiveHidden 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	Name	Type	Constraint	Quality	Default	Conformance
0	**Application**	Application-Struct	desc		MS	AP

6.4.7.3.1. Application Field

This field SHALL specify the Application to hide.

6.4.7.4. LauncherResponse Command

This command SHALL be generated in response to LaunchApp/StopApp/HideApp commands.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	Status	StatusEnum	all			M
1	Data	octstr			MS	O

6.4.7.4.1. Status Field

This field SHALL indicate the status of the command which resulted in this response.

6.4.7.4.2. Data Field

This field SHALL specify Optional app-specific data.

6.5. Audio Output Cluster

This cluster provides an interface for controlling the Output on a Video Player device such as a TV.

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. Revision History

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

Revision	Description
1	Initial Release

6.5.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	AUDIOOUTPUT

6.5.3. Cluster ID

ID	Name
0x050B	Audio Output

6.5.4. Features

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

Bit	Code	Feature	Summary
0	**NU**	NameUpdates	Supports updates to output names

6.5.5. Data Types

6.5.5.1. OutputTypeEnum Type

This data type is derived from enum8.

The type of output, expressed as an enum, with the following values:

Value	Name	Summary	Conformance
0	**HDMI**	HDMI	M
1	**BT**		M
2	**Optical**		M
3	**Headphone**		M

Value	Name	Summary	Conformance
4	**Internal**		M
5	**Other**		M

6.5.5.2. OutputInfoStruct Type

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

6.5.5.2.1. Index Field

This field SHALL indicate the unique index into the list of outputs.

6.5.5.2.2. OutputType Field

This field SHALL indicate the type of output.

6.5.5.2.3. Name Field

The device defined and user editable output name, such as “Soundbar”, “Speakers”. This field may be blank, but SHOULD be provided when known.

6.5.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**OutputList**	list[OutputInfoStruct]				R V	M
0x0001	**CurrentOutput**	uint8	all			R V	M

6.5.6.1. OutputList Attribute

This attribute provides the list of outputs supported by the device.

6.5.6.2. CurrentOutput Attribute

This attribute contains the value of the index field of the currently selected OutputInfoStruct.

6.5.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**SelectOutput**	Client ⇒ Server	Y	O	M
0x01	**RenameOutput**	Client ⇒ Server	Y	M	NU

6.5.7.1. SelectOutput 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	Name	Type	Constraint	Quality	Default	Conformance
0	**Index**	uint8	all			M

6.5.7.1.1. Index Field

This SHALL indicate the index field of the OutputInfoStruct from the OutputList attribute in which to change to.

6.5.7.2. 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	Name	Type	Constraint	Quality	Default	Conformance
0	**Index**	uint8	all			M
1	**Name**	string	all			M

6.6. Channel Cluster

This cluster provides an interface for controlling the current Channel on a device or endpoint.

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. Revision History

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

Revision	Description
1	Initial Release

6.6.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	CHANNEL

6.6.3. Cluster ID

ID	Name
0x0504	Channel

6.6.4. Features

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

Bit	Code	Feature	Summary
0	**CL**	ChannelList	Provides list of available channels.
1	**LI**	LineupInfo	Provides lineup info, which is a reference to an external source of lineup information.

6.6.5. Data Types

6.6.5.1. LineupInfoTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**MSO**	Multi System Operator	M

6.6.5.2. StatusEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Success**	Command succeeded	M

Value	Name	Summary	Conformance
1	**MultipleMatches**	More than one equal match for the ChannelInfoStruct passed in.	M
2	**NoMatches**	No matches for the ChannelInfoStruct passed in.	M

6.6.5.3. ChannelInfoStruct Type

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	Access	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

6.6.5.3.1. MajorNumber Field

This field 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.

6.6.5.3.2. MinorNumber Field

This field 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.

6.6.5.3.3. Name Field

This field 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.

6.6.5.3.4. CallSign Field

This field SHALL indicate the call sign of the channel, such as "PBS". This field is optional, but SHOULD be provided when known.

6.6.5.3.5. AffiliateCallSign Field

This field SHALL indicate the local affiliate call sign, such as "KCTS". This field is optional, but SHOULD be provided when known.

6.6.5.4. LineupInfoStruct Type

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	OperatorName	string				M
1	LineupName	string			empty	O
2	PostalCode	string			empty	O
3	LineupInfoType	LineupInfoTypeEnum	desc			M

6.6.5.4.1. OperatorName Field

This field SHALL indicate the name of the operator, for example “Comcast”.

6.6.5.4.2. LineupName Field

This field SHALL indicate the name of the provider lineup, for example "Comcast King County". This field is optional, but SHOULD be provided when known.

6.6.5.4.3. PostalCode Field

This field 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.

6.6.5.4.4. LineupInfoType Field

This field SHALL indicate the type of lineup. This field is optional, but SHOULD be provided when known.

6.6.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**ChannelList**	list[ChannelInfoStruct]			empty	R V	CL
0x0001	**Lineup**	LineupInfoStruct	desc			R V	LI

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0002	**CurrentChannel**	ChannelInfoStruct	desc	X	null	R V	O

6.6.6.1. ChannelList Attribute

This attribute SHALL provide the list of supported channels.

6.6.6.2. Lineup Attribute

This attribute SHALL identify the channel lineup using external data sources.

6.6.6.3. CurrentChannel Attribute

This attribute SHALL contain 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.

6.6.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**ChangeChannel**	Client ⇒ Server	ChangeChannelResponse	O	CL | LI
0x01	**ChangeChannelResponse**	Server ⇒ Client	N		CL | LI
0x02	**ChangeChannelByNumber**	Client ⇒ Server	Y	O	M
0x03	**SkipChannel**	Client ⇒ Server	Y	O	M

6.6.7.1. 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	Name	Type	Constraint	Quality	Default	Conformance
0	**Match**	string				M

6.6.7.1.1. Match Field

This field SHALL contain a user-input string to match in order to identify the target channel.

6.6.7.2. ChangeChannelResponse Command

This command SHALL be generated in response to a ChangeChannel command. The data for this command SHALL be as follows:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Status**	StatusEnum	desc			M
1	**Data**	string	any			O

6.6.7.2.1. Status Field

This field SHALL indicate the status of the command which resulted in this response.

6.6.7.2.2. Data Field

This field SHALL indicate Optional app-specific data.

6.6.7.3. 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	Name	Type	Constraint	Quality	Default	Conformance
0	**MajorNumber**	uint16	all			M
1	**MinorNumber**	uint16	all			M

6.6.7.3.1. MajorNumber Field

This field SHALL indicate the channel major number value (ATSC format) to which the channel should change.

6.6.7.3.2. MinorNumber Field

This field SHALL indicate the channel minor number value (ATSC format) to which the channel should change.

6.6.7.4. 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	Name	Type	Constraint	Quality	Default	Conformance
0	**Count**	int16	all			M

6.6.7.4.1. Count Field

This field SHALL indicate the number of steps to increase (Count is positive) or decrease (Count is negative) the current channel.

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.

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. Revision History

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

Revision	Description
1	Initial Release

6.7.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	CONTENTLAUNCHER

6.7.3. Cluster ID

ID	Name
0x050A	Content Launcher

6.7.4. Features

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

Bit	Code	Feature	Summary
0	**CS**	ContentSearch	Device supports content search (non-app specific)
1	**UP**	URLPlayback	Device supports basic URL-based file playback

6.7.5. Data Types

6.7.5.1. SupportedProtocolsBitmap Type

This data type is derived from map32.

Bit	Name	Summary
0	**DASH**	Device supports Dynamic Adaptive Streaming over HTTP (DASH)
1	**HLS**	Device supports HTTP Live Streaming (HLS)

6.7.5.2. StatusEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Success**	Command succeeded	M
1	**URLNotAvailable**	Requested URL could not be reached by device.	M
2	**AuthFailed**	Requested URL returned 401 error code.	M

6.7.5.3. ParameterEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Actor**	Actor represents an actor credited in video media content; for example, “Gaby Hoffman”	M
1	**Channel**	Channel represents the identifying data for a television channel; for example, "PBS"	M
2	**Character**	A character represented in video media content; for example, “Snow White”	M
3	**Director**	A director of the video media content; for example, “Spike Lee”	M
4	**Event**	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.	M

Value	Name	Summary	Conformance
5	**Franchise**	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 MediaType, rather than attempting to match to a single title.	M
6	**Genre**	Genre represents the genre of video media content such as action, drama or comedy.	M
7	**League**	League represents the categorical information for a sporting league; for example, "NCAA"	M
8	**Popularity**	Popularity indicates whether the user asks for popular content.	M
9	**Provider**	The provider (MSP) the user wants this media to be played on; for example, "Netflix".	M
10	**Sport**	Sport represents the categorical information of a sport; for example, football	M

Value	Name	Summary	Conformance
11	**SportsTeam**	SportsTeam represents the categorical information of a professional sports team; for example, "University of Washington Huskies"	M
12	**Type**	The type of content requested. Supported types are "Movie", "MovieSeries", "TVSeries", "TVSeason", "TVEpisode", "SportsEvent", and "Video"	M
13	**Video**	Video represents the identifying data for a specific piece of video content; for example, "Manchester by the Sea".	M

6.7.5.4. MetricTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Pixels**	Dimensions defined in a number of Pixels	M
1	**Percentage**	Dimensions defined as a percentage	M

6.7.5.4.1. Pixels Value

This value is used for dimensions defined in a number of Pixels.

6.7.5.4.2. Percentage Value

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.

6.7.5.5. AdditionalInfoStruct Type

This object defines additional name=value pairs that can be used for identifying content.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Name**	string	max 256				M
1	**Value**	string	max 8192				M

6.7.5.5.1. Name Field

This field SHALL indicate the name of external id, ex. "musicbrainz".

6.7.5.5.2. Value Field

This field SHALL indicate the value for external id, ex. "ST0000000666661".

6.7.5.6. ParameterStruct Type

This object defines inputs to a search for content for display or playback.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Type**	ParameterEnum	all				M
1	**Value**	string	max 1024				M
2	**ExternalIDList**	list[AdditionalInfoStruct]	all		empty		O

6.7.5.6.1. Type Field

This field SHALL indicate the entity type.

6.7.5.6.2. Value Field

This field SHALL indicate the entity value, which is a search string, ex. “Manchester by the Sea”.

6.7.5.6.3. ExternalIDList Field

This field SHALL indicate the list of additional external content identifiers.

6.7.5.7. ContentSearchStruct Type

This object defines inputs to a search for content for display or playback.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**ParameterList**	list[ParameterStruct]	all		0		M

6.7.5.7.1. ParameterList Field

This field 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'}]

6.7.5.8. DimensionStruct Type

This object defines dimension which can be used for defining Size of background images.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Width**	double			MS		M
1	**Height**	double			MS		M
2	**Metric**	MetricTypeEnum					M

6.7.5.8.1. Width Field

This field SHALL indicate the width using the metric defined in Metric

6.7.5.8.2. Height Field

This field SHALL indicate the height using the metric defined in Metric

6.7.5.8.3. Metric Field

This field SHALL indicate metric used for defining Height/Width.

6.7.5.9. StyleInformationStruct Type

This object defines style information which can be used by content providers to change the Media Player’s style related properties.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**ImageURL**	string	max 8192		MS		O
1	**Color**	string	7,9		MS		O
2	**Size**	DimensionStruct			MS		O

6.7.5.9.1. ImageURL Field

This field SHALL indicate the URL of image used for Styling different Video Player sections like Logo, Watermark etc.

6.7.5.9.2. Color Field

This field 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 hexadecimal color 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

6.7.5.9.3. Size Field

This field SHALL indicate the size of the image used for Styling different Video Player sections like Logo, Watermark etc.

6.7.5.10. BrandingInformationStruct Type

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	Name	Type	Constraint	Quality	Default	Conformance
0	**ProviderName**	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

6.7.5.10.1. ProviderName Field

This field SHALL indicate name of the provider for the given content.

6.7.5.10.2. Background Field

This field 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.

6.7.5.10.3. Logo Field

This field 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.

6.7.5.10.4. ProgressBar Field

This field SHALL indicate the style of progress bar for media playback.

6.7.5.10.5. Splash Field

This field 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.

6.7.5.10.6. Watermark Field

This field SHALL indicate watermark shown when the media is playing.

6.7.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**AcceptHeader**	list[string]	max 100[max 1024]	N	empty	R V	UP
0x0001	**SupportedStreamingProtocols**	SupportedProtocolsBitmap		N	0	R V	UP

6.7.6.1. AcceptHeader Attribute

This attribute SHALL provide a list of content types supported by the Video Player or Content App in the form of entries in the HTTP "Accept" request header.

6.7.6.2. SupportedStreamingProtocols Attribute

This attribute SHALL provide information about supported streaming protocols.

6.7.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**LaunchContent**	Client ⇒ Server	LauncherResponse	O	CS
0x01	**LaunchURL**	Client ⇒ Server	LauncherResponse	O	UP
0x02	**LauncherResponse**	Server ⇒ Client	N		CS | UP

6.7.7.1. LaunchContent Command

Upon receipt, this SHALL launch the specified content with optional search criteria.

This command returns a Launch Response.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Search**	ContentSearchStruct	desc			M
1	**AutoPlay**	bool	desc			M
2	**Data**	string			MS	O

6.7.7.1.1. Search Field

This field SHALL indicate the content to launch.

6.7.7.1.2. AutoPlay Field

This field 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.

6.7.7.1.3. Data Field

This field SHALL indicate Optional app-specific data.

6.7.7.2. 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	Name	Type	Constraint	Quality	Default	Conformance
0	**ContentURL**	string	any			M
1	**DisplayString**	string	any		MS	O
2	**BrandingInformation**	BrandingInformationStruct	any		MS	O

6.7.7.2.1. ContentURL Field

This field SHALL indicate the URL of content to launch.

6.7.7.2.2. DisplayString Field

This field, if present, SHALL provide a string that MAY be used to describe the content being accessed at the given URL.

6.7.7.2.3. BrandingInformation Field

This field, if present, SHALL indicate the branding information that MAY be displayed when playing back the given content.

6.7.7.3. LauncherResponse Command

This command SHALL be generated in response to LaunchContent and LaunchURL commands.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Status**	StatusEnum	all			M
1	**Data**	string			MS	O

6.7.7.3.1. Status Field

This field SHALL indicate the status of the command which resulted in this response.

6.7.7.3.2. Data Field

This field SHALL indicate Optional app-specific data.

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.

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. Revision History

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

Revision	Description
1	Initial Release

6.8.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	KEYPADINPUT

6.8.3. Cluster ID

ID	Name
0x0509	Keypad Input

6.8.4. Features

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

Bit	Code	Feature	Summary
0	**NV**	NavigationKeyCodes	Supports UP, DOWN, LEFT, RIGHT, SELECT, BACK, EXIT, MENU
1	**LK**	LocationKeys	Supports CEC keys 0x0A (Settings) and 0x09 (Home)
2	**NK**	NumberKeys	Supports numeric input 0..9

6.8.5. Data Types

6.8.5.1. StatusEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Success**	Succeeded	M
1	**UnsupportedKey**	Key code is not supported.	M
2	**InvalidKeyInCurrentState**	Requested key code is invalid in the context of the responder's current state.	M

6.8.6. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**SendKey**	Client ⇒ Server	SendKeyResponse	O	M
0x01	**SendKeyResponse**	Server ⇒ Client	N		M

6.8.6.1. 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	Name	Type	Constraint	Quality	Default	Conformance
0	**KeyCode**	uint8	all			M

6.8.6.1.1. KeyCode Field

This field SHALL indicate the key code to process.

6.8.6.2. SendKeyResponse Command

This command SHALL be generated in response to a SendKey command. The data for this command SHALL be as follows:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Status**	StatusEnum	all			M

6.8.6.2.1. Status Field

This field SHALL indicate the status of the request.

6.9. Media Input Cluster

This cluster provides an interface for controlling the Input Selector on a media device such as a Video Player.

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. Revision History

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

Revision	Description
1	Initial Release

6.9.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	MEDIAINPUT

6.9.3. Cluster ID

ID	Name
0x0507	Media Input

6.9.4. Features

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

Bit	Code	Feature	Summary
0	**NU**	NameUpdates	Supports updates to the input names

6.9.5. Data Types

6.9.5.1. InputTypeEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Internal**	Indicates content not coming from a physical input.	M
1	**Aux**		M
2	**Coax**		M
3	**Composite**		M
4	**HDMI**		M

Value	Name	Summary	Conformance
5	**Input**		M
6	**Line**		M
7	**Optical**		M
8	**Video**		M
9	**SCART**		M
10	**USB**		M
11	**Other**		M

6.9.5.2. InputInfoStruct Type

This contains information about an input.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Index**	uint8	all				M
1	**InputType**	InputTypeEnum	desc				M
2	**Name**	string					M
3	**Description**	string					M

6.9.5.2.1. Index Field

This field SHALL indicate the unique index into the list of Inputs.

6.9.5.2.2. InputType Field

This field SHALL indicate the type of input

6.9.5.2.3. Name Field

This field SHALL indicate the input name, such as “HDMI 1”. This field may be blank, but SHOULD be provided when known.

6.9.5.2.4. Description Field

This field SHALL indicate the user editable input description, such as “Living room Playstation”. This field may be blank, but SHOULD be provided when known.

6.9.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**InputList**	list[InputInfoStruct]				R V	M
0x0001	**CurrentInput**	uint8	all			R V	M

6.9.6.1. InputList Attribute

This attribute SHALL provide a list of the media inputs supported by the device.

6.9.6.2. CurrentInput Attribute

This attribute SHALL contain the value of the index field of the currently selected InputInfoStruct.

6.9.7. 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

6.9.7.1. SelectInput Command

Upon receipt, this command SHALL change the media input on the device to the input at a specific index in the Input List.

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Index**	uint8	all			M

6.9.7.1.1. Index Field

This field SHALL indicate the index field of the InputInfoStruct from the InputList attribute in which to change to.

6.9.7.2. ShowInputStatus Command

Upon receipt, this command SHALL display the active status of the input list on screen.

6.9.7.3. HideInputStatus Command

Upon receipt, this command SHALL hide the input list from the screen.

6.9.7.4. RenameInput Command

Upon receipt, this command 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	Name	Type	Constraint	Quality	Default	Conformance
0	**Index**	uint8	all			M
1	**Name**	string	all			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.

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. Revision History

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

Revision	Description
1	Initial Release

6.10.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	MEDIAPLAYBACK

6.10.3. Cluster ID

ID	Name
0x0506	Media Playback

6.10.4. Features

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

Bit	Code	Feature	Summary
0	**AS**	AdvancedSeek	Enables clients to implement more advanced media seeking behavior in their user interface, such as for example a "seek bar".
1	**VS**	VariableSpeed	Support for commands to support variable speed playback on media that supports it.

6.10.5. Data Types

6.10.5.1. PlaybackStateEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Playing**	Media is currently playing (includes FF and REW)	M
1	**Paused**	Media is currently paused	M
2	**NotPlaying**	Media is not currently playing	M
3	**Buffering**	Media is not currently buffering and playback will start when buffer has been filled	M

6.10.5.2. StatusEnum Type

Status Data Type is derived from enum8.

Value	Name	Summary	Conformance
0	**Success**	Succeeded	M
1	**InvalidStateForCommand**	Requested playback command is invalid in the current playback state.	M

Value	Name	Summary	Conformance
2	**NotAllowed**	Requested playback command is not allowed in the current playback state. For example, attempting to fast-forward during a commercial might return NotAllowed.	M
3	**NotActive**	This endpoint is not active for playback.	M
4	**SpeedOutOfRange**	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.	VS
5	**SeekOutOfRange**	The Seek Command was issued with a value of position outside of the allowed seek range of the media.	AS

6.10.5.3. PlaybackPositionStruct Type

This structure defines a playback position within a media stream being played.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**UpdatedAt**	epoch-us	all				M
1	**Position**	uint64	all	X			M

6.10.5.3.1. UpdatedAt Field

This field SHALL indicate the time when the position was last updated.

6.10.5.3.2. Position Field

This field 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).

6.10.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**CurrentState**	PlaybackStateEnum	desc			R V	M
0x0001	**StartTime**	epoch-us	desc	X	null	R V	AS
0x0002	**Duration**	uint64	desc	X	null	R V	AS
0x0003	**SampledPosition**	PlaybackPositionStruct	desc	X	null	R V	AS
0x0004	**PlaybackSpeed**	single	desc		0	R V	AS
0x0005	**SeekRangeEnd**	uint64	desc	X	null	R V	AS
0x0006	**SeekRangeStart**	uint64	desc	X	null	R V	AS

6.10.6.1. CurrentState Attribute

This attribute SHALL indicate the current playback state of media.

During fast-forward, rewind, and other seek operations; this attribute SHALL be set to PLAYING.

6.10.6.2. StartTime Attribute

This attribute 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.

6.10.6.3. Duration Attribute

This attribute 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.

6.10.6.4. SampledPosition Attribute

This attribute 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

6.10.6.5. PlaybackSpeed Attribute

This attribute 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 PlaybackSpeed 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

Seconds of Media Played	Actual Time Taken in Seconds	Direction of playback	PlaybackSpeed
1	2	Reverse	-0.5

6.10.6.6. SeekRangeStart Attribute

This attribute 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.

6.10.6.7. SeekRangeEnd Attribute

This attribute 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.

6.10.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**Play**	Client ⇒ Server	PlaybackResponse	O	M
0x01	**Pause**	Client ⇒ Server	PlaybackResponse	O	M
0x02	**Stop**	Client ⇒ Server	PlaybackResponse	O	M
0x03	**StartOver**	Client ⇒ Server	PlaybackResponse	O	O
0x04	**Previous**	Client ⇒ Server	PlaybackResponse	O	O
0x05	**Next**	Client ⇒ Server	PlaybackResponse	O	O
0x06	**Rewind**	Client ⇒ Server	PlaybackResponse	O	VS
0x07	**FastForward**	Client ⇒ Server	PlaybackResponse	O	VS
0x08	**SkipForward**	Client ⇒ Server	PlaybackResponse	O	O
0x09	**SkipBackward**	Client ⇒ Server	PlaybackResponse	O	O

ID	Name	Direction	Response	Access	Conformance
0x0A	**PlaybackResponse**	Server ⇒ Client	N		M
0x0B	**Seek**	Client ⇒ Server	PlaybackResponse	O	AS

6.10.7.1. 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.

6.10.7.2. Pause Command

Upon receipt, this SHALL pause playback of the media.

6.10.7.3. 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.

6.10.7.4. StartOver Command

Upon receipt, this SHALL Start Over with the current media playback item.

6.10.7.5. 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.

6.10.7.6. 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.

6.10.7.7. 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 backwards.

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.

6.10.7.8. 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.

6.10.7.9. SkipForward Command

Upon receipt, this SHALL Skip forward in the media by the given number of milliseconds, using the data as follows:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**DeltaPositionMilliseconds**	uint64	all			M

6.10.7.9.1. DeltaPositionMilliseconds Field

This field 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.

6.10.7.10. SkipBackward Command

Upon receipt, this SHALL Skip backward in the media by the given number of milliseconds, using the data as follows:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**DeltaPositionMilliseconds**	uint64	all			M

6.10.7.10.1. DeltaPositionMilliseconds Field

This field 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.

6.10.7.11. Seek Command

Upon receipt, this SHALL change the playback position in the media to the given position using data as follows:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Position**	uint64	all			M

6.10.7.11.1. Position Field

This field 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.

6.10.7.12. PlaybackResponse Command

This command SHALL be generated in response to various Playback Commands. The data for this command SHALL be as follows:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**Status**	StatusEnum	desc			M
1	**Data**	string	any			O

6.10.7.12.1. Status Field

This field SHALL indicate the status of the command which resulted in this response.

6.10.7.12.2. Data Field

This field SHALL indicate Optional app-specific data.

6.11. Target Navigator Cluster

This cluster provides an interface for UX navigation within a set of targets on a device or endpoint.

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. Revision History

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

Revision	Description
1	Initial Release

6.11.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	TGTNAV

6.11.3. Cluster ID

ID	Name
0x0505	Target Navigator

6.11.4. Data Types

6.11.4.1. StatusEnum Type

This data type is derived from enum8.

Value	Name	Summary	Conformance
0	**Success**	Command succeeded	M
1	**TargetNotFound**	Requested target was not found in the TargetList	M
2	**NotAllowed**	Target request is not allowed in current state.	M

6.11.4.2. TargetInfoStruct Type

This indicates an object describing the navigable target.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Identifier**	uint8	all				M
1	**Name**	string					M

6.11.4.2.1. Identifier Field

This field SHALL contain an unique id within the TargetList.

6.11.4.2.2. Name Field

This field SHALL contain a name string for the TargetInfoStruct.

6.11.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**TargetList**	list[TargetInfoStruct]				R V	M
0x0001	**CurrentTarget**	uint8	desc	X	null	R V	O

6.11.5.1. TargetList Attribute

This 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.

6.11.5.2. CurrentTarget Attribute

This 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.

6.11.6. Commands

ID	Name	Direction	Response	Access	Conformance
0x00	**NavigateTarget**	Client ⇒ Server	NavigateTargetResponse	O	M
0x01	**NavigateTargetResponse**	Server ⇒ Client	N		M

6.11.6.1. 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

6.11.6.1.1. Target Field

This field 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.

6.11.6.1.2. Data Field

This field SHALL indicate Optional app-specific data.

6.11.6.2. 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

6.11.6.2.1. Status Field

This field SHALL indicate the of the command.

6.11.6.2.2. Data Field

This field SHALL indicate Optional app-specific data.

Chapter 7. Robots

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.

7.1. General Description

7.1.1. Introduction

The clusters specified in this section define the operation of robotic devices, such as Robotic Vacuum Cleaners (RVCs).

7.1.2. Cluster List

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

Table 39. Overview of the RVC Clusters

Cluster ID	Cluster Name	Description
0x0054	RVC Run Mode	Commands and attributes for controlling the running mode of an RVC device.
0x0055	RVC Clean Mode	Commands and attributes for controlling the cleaning mode of an RVC device.
0x0061	RVC Operational State	Commands and attributes for monitoring and controlling the operational state of an RVC device.

7.2. RVC Run Mode Cluster

This cluster is derived from the Mode Base cluster to define specifics for Robotic Vacuum Cleaner devices. It also defines a namespace for the running modes of these devices.

7.2.1. Revision History

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

Revision	Description
1	Initial Release

7.2.2. Classification

Hierarchy	Role	Scope	PICS Code
Mode Base	Application	Endpoint	RVCRUNM

7.2.3. Cluster ID

ID	Name
0x0054	RVC Run Mode

7.2.4. Data Types

7.2.4.1. ModeOptionStruct Type

The table below lists the changes relative to the Mode Base cluster for the fields of the ModeOptionStruct type. A blank field indicates no change.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Label**						M
1	**Mode**						M
2	**ModeTags**		1 to 8				M

At least one SupportedMode attribute list entry SHALL include the Idle mode tag in the ModeTags field.

At least one SupportedMode attribute list entry (different from the one above) SHALL include the Cleaning mode tag in the ModeTags field.

The Cleaning and Idle mode tags are mutually exclusive and SHALL NOT both be used together in a mode's ModeTags.

7.2.5. Attributes

7.2.5.1. StartUpMode Attribute

If this attribute is supported, the device SHOULD initially set this to one of the supported modes that has the Idle tag associated with it. See the Mode Base cluster specification for full details about this StartUpMode attribute.

7.2.6. Derived Cluster Namespace

This namespace includes definitions for data associated exclusively with the derived cluster.

7.2.6.1. ChangeToModeResponse Command Namespace Definitions

The following table defines the derived cluster specific StatusCode values.

Status Code Value	Name
0x41	**Stuck**
0x42	**DustBinMissing**
0x43	**DustBinFull**
0x44	**WaterTankEmpty**
0x45	**WaterTankMissing**
0x46	**WaterTankLidOpen**
0x47	**MopCleaningPadMissing**
0x48	**BatteryLow**

7.2.6.2. Mode Tags

The following table defines the derived cluster specific ModeTag values.

Mode Tag Value	Name
0x4000	**Idle**
0x4001	**Cleaning**

7.2.6.2.1. Idle Tag

The device is not performing any of the main operations of the other modes. However, auxiliary actions, such as seeking the charger or charging, may occur.

For example, the device has completed cleaning, successfully or not, on its own or due to a command, or has not been asked to clean after a restart.

7.2.6.2.2. Cleaning Tag

The device was asked to clean so it may be actively running, or paused due to an error, due to a pause command, or for recharging etc. If currently paused and the device can resume it will continue to clean.

7.2.7. Mode Examples

Starting a cleaning cycle is done by switching from a mode with the Idle tag to a mode with the Cleaning tag.

Stopping a cleaning cycle is done by switching from a mode with the Cleaning tag to a mode with the Idle tag.

7.3. RVC Clean Mode Cluster

This cluster is derived from the Mode Base cluster to define specifics for Robotic Vacuum Cleaner devices. It also defines a namespace for the cleaning type for these devices.

7.3.1. Revision History

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

Revision	Description
1	Initial Release

7.3.2. Classification

Hierarchy	Role	Scope	PICS Code
Mode Base	Application	Endpoint	RVCCLEANM

7.3.3. Cluster ID

ID	Name
0x0055	RVC Clean Mode

7.3.4. Data Types

7.3.4.1. ModeOptionStruct Type

The table below lists the changes relative to the Mode Base cluster for the fields of the ModeOptionStruct type. A blank field indicates no change.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Label**						M
1	**Mode**						M
2	**ModeTags**		1 to 8				M

At least one SupportedMode attribute list entry SHALL include the Vacuum and/or the Mop mode tag in the ModeTags field list.

7.3.5. Derived Cluster Namespace

This namespace includes definitions for data associated exclusively with the derived cluster.

7.3.5.1. ChangeToModeResponse Command Namespace Definitions

The following table defines the derived cluster specific StatusCode values.

Status Code Value	Name
0x40	**CleaningInProgress**

7.3.5.2. Mode Tags

The following table defines the derived cluster specific ModeTag values.

Mode Tag Value	Name
0x4000	**DeepClean**
0x4001	**Vacuum**
0x4002	**Mop**

7.3.5.2.1. Deep Clean Tag

While in this mode, the device is optimizing for improved cleaning.

7.3.5.2.2. Vacuum Tag

The device’s vacuuming feature is enabled in this mode.

7.3.5.2.3. Mop Tag

The device’s mopping feature is enabled in this mode.

7.3.6. Mode Examples

A few examples of modes and their mode tags are provided below.

For the "Turbo, Vacuum Only" mode, tags: 0x4000 (Deep Clean), 0x4001 (Vacuum).

For the "Mop Only" mode, tags: 0x4002 (Mop), 0x0003 (Low Noise).

For the "Rapid Vacuum and Mop" mode, tags: 0x0001 (Quick), 0x4001 (Vacuum), 0x4002 (Mop).

Note that the "Low Noise" and "Quick" mode tags are defined in the generic Mode Base cluster specification.

7.4. RVC Operational State Cluster

This cluster provides an interface for monitoring the operational state of a Robotic Vacuum Cleaner.

7.4.1. Revision History

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

Revision	Description
1	Initial release

7.4.2. Classification

Hierarchy	Role	Scope	PICS Code
Operational State	Application	Endpoint	RVCOPSTATE

7.4.3. Cluster ID

ID	Name
0x0061	RVC Operational State

7.4.4. Data Types

7.4.4.1. OperationalStateEnum Type

This data type is derived from enum8.

The values defined herein are applicable to this derived cluster of Operational State only and are additional to the set of values defined in Operational State itself.

Value	Name	Summary	Conformance
0x40	**SeekingCharger**	The device is en route to the charging dock	M
0x41	**Charging**	The device is charging	M
0x42	**Docked**	The device is on the dock, not charging	M

7.4.4.2. ErrorStateEnum Type

This data type is derived from enum8.

The values defined herein are applicable to this derived cluster of Operational State only and are additional to the set of values defined in Operational State itself.

Value	Name	Summary	Conformance
0x40	**FailedToFindChargingDock**	The device has failed to find or reach the charging dock	M
0x41	**Stuck**	The device is stuck and requires manual intervention	M
0x42	**DustBinMissing**	The device has detected that its dust bin is missing	M

Value	Name	Summary	Conformance
0x43	**DustBinFull**	The device has detected that its dust bin is full	M
0x44	**WaterTankEmpty**	The device has detected that its water tank is empty	M
0x45	**WaterTankMissing**	The device has detected that its water tank is missing	M
0x46	**WaterTankLidOpen**	The device has detected that its water tank lid is open	M
0x47	**MopCleaningPadMissing**	The device has detected that its cleaning pad is missing	M

Chapter 8. Home Appliances

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.

8.1. General Description

8.1.1. Introduction

The clusters specified in this section are typically used in control of home appliances, such as laundry washers, refrigerators etc.

8.1.2. Cluster List

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

Table 40. Overview of the Home Appliance Clusters

Cluster ID	Cluster Name	Description
Common Clusters		
0x0056	Temperature Control	Commands and attributes for control of a temperature set point
Dishwasher Clusters		
0x0059	Dishwasher Mode	Commands and attributes for controlling a dishwasher
0x005D	Dishwasher Alarm	Alarm definitions for Dishwasher devices
Laundry Washer Clusters		
0x0051	Laundry Washer Mode	Commands and attributes for controlling a laundry washer
0x0053	Laundry Washer Controls	Commands and attributes for the control of options on a device that does laundry washing
Refrigerator Clusters		
0x0052	Refrigerator And Temperature Controlled Cabinet Mode	Commands and attributes for controlling a refrigerator or a temperature controlled cabinet
0x0057	Refrigerator Alarm	Alarm definitions for Refrigerator devices

8.2. Temperature Control Cluster

This cluster provides an interface to the setpoint temperature on devices such as washers, refrigerators, and water heaters. The setpoint temperature is the temperature to which a device using this cluster would attempt to control to. This cluster does not provide access to the actual or physical temperature associated with any device using this cluster. Access to the physical temperature associated with a device using this cluster would be provided by other clusters as part of that devices device type definition.

The values and constraints of the attributes communicated to clients SHOULD match the controls on any physical interface on a device implementing this server. For example, the value of the Step attribute SHOULD match the incremental value by which the temperature setpoint can be changed on the physical device.

8.2.1. Revision History

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

Rev	Description
1	Initial release

8.2.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	TCTL

8.2.3. Cluster ID

ID	Name
0x0056	Temperature Control

8.2.4. Features

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

Bit	Code	Feature	Conformance	Summary
0	**TN**	TemperatureNumber	O.a	Use actual temperature numbers
1	**TL**	TemperatureLevel	O.a	Use temperature levels
2	**STEP**	TemperatureStep	[TN]	Use step control with temperature numbers

8.2.4.1. TemperatureNumber Feature

For devices that use an actual temperature value for the temperature setpoint, such as some water heaters, the feature TN SHALL be used. Note that this cluster provides and supports temperatures in degrees Celsius via the `temperature` data type.

8.2.4.2. TemperatureLevel Feature

For devices that use vendor-specific temperature levels for the temperature setpoint, such as some washers, the feature TL SHALL be used.

8.2.4.3. TemperatureStep Feature

For devices that support discrete temperature setpoints that are larger than the temperature resolution imposed via the `temperature` data type, the Step feature MAY be used.

8.2.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**TemperatureSetpoint**	temperature	MinTemperature to MaxTemperature			R V	TN
0x0001	**MinTemperature**	temperature	max (MaxTemperature - 1)*	F		R V	TN
0x0002	**MaxTemperature**	temperature	desc	F		R V	TN
0x0003	**Step**	temperature	max (MaxTemperature - MinTemperature)	F		R V	STEP
0x0004	**SelectedTemperatureLevel**	uint8	0 to 31			R V	TL
0x0005	**SupportedTemperatureLevels**	list[string]	max 32[max 16]			R V	TL

NOTE * See temperature data type, in the data model, for encoding units.

8.2.5.1. TemperatureSetpoint Attribute

This attribute SHALL represent the desired Temperature Setpoint on the device.

8.2.5.2. MinTemperature Attribute

This attribute SHALL represent the minimum temperature to which the TemperatureSetpoint attribute MAY be set.

8.2.5.3. MaxTemperature Attribute

This attribute SHALL represent the maximum temperature to which the TemperatureSetpoint attribute MAY be set.

If the Step attribute is supported, this attribute SHALL be such that MaxTemperature = MinTemperature + Step * n, where n is an integer and n > 0. If the Step attribute is not supported, this attribute SHALL be such that MaxTemperature > MinTemperature.

8.2.5.4. Step Attribute

This attribute SHALL represent the discrete value by which the TemperatureSetpoint attribute can be changed via the SetTemperature command.

> For example, if the value of MinTemperature is 25.00C (2500) and the Step value is 0.50C (50), valid values of the TargetTemperature field of the SetTemperature command would be 25.50C (2550), 26.00C (2600), 26.50C (2650), etc.

8.2.5.5. SelectedTemperatureLevel Attribute

This attribute SHALL represent the currently selected temperature level setting of the server. This attribute SHALL be the positional index of the list item in the SupportedTemperatureLevels list that represents the currently selected temperature level setting of the server.

8.2.5.6. SupportedTemperatureLevels Attribute

This attribute SHALL represent the list of supported temperature level settings that may be selected via the TargetTemperatureLevel field in the SetTemperature command. Each string is readable text that describes each temperature level setting in a way that can be easily understood by humans. For example, a washing machine can have temperature levels like "Cold", "Warm", and "Hot". Each string is specified by the manufacturer.

Each item in this list SHALL represent a unique temperature level. Each entry in this list SHALL have a unique value. The entries in this list SHALL appear in order of increasing temperature level with list item 0 being the setting with the lowest temperature level.

8.2.6. Commands

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

8.2.6.1. SetTemperature Command

The SetTemperature command SHALL have the following data fields:

ID	Name	Type	Constraint	Quality	Default	Conformance
0	**TargetTemperature**	temperature	desc			TN
1	**TargetTemperatureLevel**	uint8	desc			TL

8.2.6.1.1. TargetTemperature Field

This field SHALL specify the desired temperature setpoint that the server is to be set to.

The TargetTemperature SHALL be from MinTemperature to MaxTemperature inclusive. If the Step attribute is supported, TargetTemperature SHALL be such that (TargetTemperature - MinTemperature) % Step == 0.

8.2.6.1.2. TargetTemperatureLevel Field

This field SHALL specify the index of the list item in the SupportedTemperatureLevels list that represents the desired temperature level setting of the server. The value of this field SHALL be between 0 and the length of the SupportedTemperatureLevels list -1.

8.2.6.1.3. Effect on Receipt

If the TargetTemperature or TargetTemperatureLevel fields of the command meet all constraints but the server is unable to execute the command at the time the command is received by the server (e.g. due to the design of a device it cannot accept a change in its temperature setting after it has begun operation), then the server SHALL respond with a status code of INVALID_IN_STATE, and discard the command.

If the TN feature is supported, on receipt of this command,

- If the value of the TargetTemperature field meets all constraints, the server SHALL set the TemperatureSetpoint attribute to the value of the TargetTemperature field and the response SHALL have a status code of SUCCESS.
- Otherwise (e.g. if the value of the TargetTemperature field falls outside of the constraints of the TemperatureSetpoint attribute or if the Step attribute is supported in the server and the value of the TargetTemperature field is such that (TargetTemperature - MinTemperature) % Step != 0), the status of the response SHALL be CONSTRAINT_ERROR and the value of the TemperatureSetpoint attribute SHALL remain unchanged.

If the TL feature is supported, on receipt of this command,

- If value of the TargetTemperatureLevel field meets all constraints, the server SHALL set its SelectedTemperatureLevel attribute to the value of TargetTemperatureLevel field and respond with status SUCCESS.
- Otherwise (e.g. if the value of the TargetTemperatureLevel field is out of bounds of the SupportedTemperatureLevels list), the status of the response SHALL be CONSTRAINT_ERROR, and the value of SelectedTemperatureLevel SHALL remain unchanged.

8.3. Dishwasher Mode Cluster

This cluster is derived from the Mode Base cluster, defining additional mode tags and namespaced enumerated values for dishwasher devices.

8.3.1. Revision History

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

Revision	Description
1	Initial Release

8.3.2. Classification

Hierarchy	Role	Scope	PICS Code
Mode Base	Application	Endpoint	DISHM

8.3.3. Cluster ID

ID	Name
0x0059	Dishwasher Mode

8.3.4. Data Types

8.3.4.1. ModeOptionStruct Type

The table below lists the changes relative to the Mode Base cluster for the fields of the ModeOptionStruct type. A blank field indicates no change.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Label**						M
1	**Mode**						M
2	**ModeTags**		1 to 8				M

At least one SupportedMode attribute list entry SHALL include the Normal mode tag in the ModeTags field list.

8.3.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**SupportedModes**						M
0x0001	**CurrentMode**						M
0x0002	**StartUpMode**						P
0x0003	**OnMode**						P

8.3.5.1. StartUpMode Attribute

If this attribute is supported, the device SHOULD initially set this to one of the supported modes that has the Normal tag associated with it. See the Mode Base cluster specification for full details about the StartUpMode attribute.

8.3.6. Derived Cluster Namespace

This namespace includes definitions for data associated exclusively with the derived cluster.

8.3.6.1. Mode Tags

The following table defines the derived cluster specific ModeTag values.

Mode Tag Value	Name
0x4000	**Normal**
0x4001	**Heavy**
0x4002	**Light**

8.3.6.1.1. Normal Tag

The normal regime of operation.

8.3.6.1.2. Heavy Tag

Mode optimized for washing heavily-soiled dishes.

8.3.6.1.3. Light Tag

Mode optimized for light washing.

8.4. Dishwasher Alarm Cluster

This cluster is a derived cluster of the Alarm Base cluster.

8.4.1. Revision History

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

Revision	Description
1	Initial revision

8.4.2. Classification

Hierarchy	Role	Scope	PICS Code
Alarm Base	Application	Endpoint	DISHALM

8.4.3. Cluster ID

ID	Name
0x005D	Dishwasher Alarm

8.4.4. Data Types

8.4.4.1. AlarmMap Type

This data type is derived from map32.

Bit	Name	Summary	Conformance
0	**InflowError**	Water inflow is abnormal	P,O.a+
1	**DrainError**	Water draining is abnormal	P,O.a+
2	**DoorError**	Door or door lock is abnormal	O.a+
3	**TempTooLow**	Unable to reach normal temperature	P,O.a+
4	**TempTooHigh**	Temperature is too high	P,O.a+
5	**WaterLevelError**	Water level is abnormal	P,O.a+

8.5. Laundry Washer Mode Cluster

This cluster is derived from the Mode Base cluster, defining additional mode tags and namespaced enumerated values for laundry washer devices.

8.5.1. Revision History

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

Revision	Description
1	Initial Release

8.5.2. Classification

Hierarchy	Role	Scope	PICS Code
Mode Base	Application	Endpoint	LWM

8.5.3. Cluster ID

ID	Name
0x0051	Laundry Washer Mode

8.5.4. Data Types

8.5.4.1. ModeOptionStruct Type

The table below lists the changes relative to the Mode Base cluster for the fields of the ModeOptionStruct type. A blank field indicates no change.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Label**						M
1	**Mode**						M
2	**ModeTags**		1 to 8				M

At least one SupportedMode attribute list entry SHALL include the Normal mode tag in the ModeTags field list.

8.5.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**SupportedModes**						M
0x0001	**CurrentMode**						M
0x0002	**StartUpMode**						P
0x0003	**OnMode**						P

8.5.5.1. StartUpMode Attribute

If this attribute is supported, the device SHOULD initially set this to one of the supported modes that has the Normal tag associated with it. See the Mode Base cluster specification for full details about the StartUpMode attribute.

8.5.6. Derived Cluster Namespace

This namespace includes definitions for data associated exclusively with the derived cluster.

8.5.6.1. Mode Tags

The following table defines the derived cluster specific ModeTag values.

Mode Tag Value	Name
0x4000	**Normal**
0x4001	**Delicate**
0x4002	**Heavy**
0x4003	**Whites**

8.5.6.1.1. Normal Tag

The normal regime of operation.

8.5.6.1.2. Delicate Tag

Mode optimized for washing delicate garments.

8.5.6.1.3. Heavy Tag

Mode optimized for heavy washing.

8.5.6.1.4. Whites Tag

Mode optimized for stain removal on white fabrics.

8.5.7. Mode Examples

A few examples of Laundry Washer modes and their mode tags are provided below.

- For the "Heavy Wash, Whites" mode, tags: 0x4002 (Heavy), 0x4003 (Whites).
- For the "Fast" mode, tags: 0x0001 (Quick), 0x4000 (Normal).

8.6. Laundry Washer Controls

This cluster provides a way to access options associated with the operation of a laundry washer device type.

8.6.1. Revision History

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

Rev	Description
1	Initial release

8.6.2. Classification

Hierarchy	Role	Scope	PICS Code
Base	Application	Endpoint	WASHERCTRL

8.6.3. Cluster ID

ID	Name
0x0053	Laundry Washer Controls

8.6.4. Features

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

Bit	Code	Feature	Conformance	Summary
0	**SPIN**	Spin	O	Multiple spin speeds supported
1	**RINSE**	Rinse	O	Multiple rinse cycles supported

8.6.4.1. Spin Feature

This feature indicates multiple spin speeds are supported in at least one supported mode. Note that some modes may not support multiple spin speeds even if this feature is supported.

8.6.4.2. Rinse Feature

This feature indicates multiple rinse cycles are supported in at least one supported mode. Note that some modes may not support selection of the number of rinse cycles even if this feature is supported.

8.6.5. Data Types

8.6.5.1. NumberOfRinsesEnum Type

This data type is derived from enum8.

The NumberOfRinsesEnum provides a representation of the number of rinses that will be performed for a selected mode. NumberOfRinsesEnum is derived from enum8. It is up to the device manufacturer to determine the mapping between the enum values and the corresponding numbers of rinses.

Value	Name	Conformance	Description
0	**None**	RINSE	This laundry washer mode does not perform rinse cycles
1	**Normal**	RINSE	This laundry washer mode performs normal rinse cycles determined by the manufacturer
2	**Extra**	RINSE	This laundry washer mode performs an extra rinse cycle
3	**Max**	RINSE	This laundry washer mode performs the maximum number of rinse cycles determined by the manufacturer

8.6.6. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**SpinSpeeds**	list[string]	max 16[max 64]			R V	SPIN
0x0001	**SpinSpeedCurrent**	uint8	0 to 15	X	desc	RW VO	SPIN

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0002	**NumberOfRinses**	NumberOfRinsesEnum	desc		1	RW VO	RINSE
0x0003	**SupportedRinses**	list[NumberOfRinsesEnum]	max 4			R V	RINSE

8.6.6.1. SpinSpeeds Attribute

This attribute indicates the list of spin speeds available to the appliance in the currently selected mode. The spin speed values are determined by the manufacturer. At least one spin speed value SHALL be provided in the SpinSpeeds list. The list of spin speeds MAY change depending on the currently selected Laundry Washer mode. For example, Quick mode might have a completely different list of SpinSpeeds than Delicates mode.

8.6.6.2. SpinSpeedCurrent Attribute

This attribute indicates the currently selected spin speed. It is the index into the SpinSpeeds list of the selected spin speed, as such, this attribute can be an integer between 0 and the number of entries in SpinSpeeds - 1. If a value is received that is outside of the defined constraints, a CONSTRAINT_ERROR SHALL be sent as the response. If a value is attempted to be written that doesn't match a valid index (e.g. an index of 5 when the list has 4 values), a CONSTRAINT_ERROR SHALL be sent as the response. If null is written to this attribute, there will be no spin speed for the selected cycle. If the value is null, there will be no spin speed on the current mode.

8.6.6.3. NumberOfRinses Attribute

This attribute represents how many times a rinse cycle SHALL be performed on a device for the current mode of operation. A value of None SHALL indicate that no rinse cycle will be performed. This value may be set by the client to adjust the number of rinses that are performed for the current mode of operation. If the device is not in a compatible state to accept the provided value, an INVALID_IN_STATE error SHALL be sent as the response.

8.6.6.4. SupportedRinses Attribute

This attribute represents the amount of rinses allowed for a specific mode. Each entry SHALL indicate a NumberOfRinsesEnum value that is possible in the selected mode on the device. The value of this attribute MAY change at runtime based on the currently selected mode. Each entry SHALL be distinct.

8.7. Refrigerator And Temperature Controlled Cabinet Mode Cluster

This cluster is derived from the Mode Base cluster, defining additional mode tags and namespaced enumerated values for refrigerator and temperature controlled cabinet devices.

8.7.1. Revision History

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

Revision	Description
1	Initial Release

8.7.2. Classification

Hierarchy	Role	Scope	PICS Code
Mode Base	Application	Endpoint	TCCM

8.7.3. Cluster ID

ID	Name
0x0052	Refrigerator And Temperature Controlled Cabinet Mode

8.7.4. Data Types

8.7.4.1. ModeOptionStruct Type

The table below lists the changes relative to the Mode Base cluster for the fields of the ModeOptionStruct type. A blank field indicates no change.

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0	**Label**						M
1	**Mode**						M
2	**ModeTags**		1 to 8				M

At least one SupportedMode attribute list entry SHALL include the Auto mode tag in the ModeTags field list.

8.7.5. Attributes

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0000	**SupportedModes**						M
0x0001	**CurrentMode**						M

ID	Name	Type	Constraint	Quality	Default	Access	Conformance
0x0002	**StartUpMode**						P
0x0003	**OnMode**						P

8.7.6. Derived Cluster Namespace

This namespace includes definitions for data associated exclusively with the derived cluster.

8.7.6.1. Mode Tags

The following table defines the derived cluster specific ModeTag values.

Mode Tag Value	Name
0x4000	**RapidCool**
0x4001	**RapidFreeze**

8.7.6.1.1. RapidCool Tag

This mode reduces the temperature rapidly, typically above freezing grade.

8.7.6.1.2. RapidFreeze Tag

This mode reduces the temperature rapidly, below freezing grade.

8.7.7. Mode Examples

A few examples of Refrigerator and Temperature Controlled Cabinet modes and their mode tags are provided below.

- For the "Normal" mode, tags: 0x0000 (Auto)
- For the "Energy Save" mode, tags: 0x0004 (LowEnergy)
- For the "Rapid Cool" mode, tags: 0x4000 (RapidCool)

8.8. Refrigerator Alarm Cluster

This cluster is a derived cluster of Alarm Base cluster.

8.8.1. Revision History

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

Revision	Description
1	Initial revision

8.8.2. Classification

Hierarchy	Role	Scope	PICS Code
Alarm Base	Application	Endpoint	REFALM

8.8.3. Cluster ID

ID	Name
0x0057	Refrigerator Alarm

8.8.4. Features

Bit	Code	Feature	Conformance	Summary
0	**RESET**	Reset	X	Supports the ability to reset alarms

8.8.5. Data Types

8.8.5.1. AlarmMap Type

This data type is derived from map32.

Bit	Name	Summary	Conformance
0	**DoorOpen**	The cabinet's door has been open for a vendor defined amount of time.	M

8.8.6. Attributes

8.8.6.1. Mask Attribute

If the generation of the alarm has not been suppressed at the device itself, then this attribute SHALL have these fixed values.

Bit	Name	Value
0	**DoorOpen**	1

This alarm SHALL be cleared only when the door is closed (manual action).

If the generation of the alarm is suppressed at the device itself, then bit 0 SHALL have a value of 0. It SHALL be re-set to 1 if the alarm is re-enabled at the device itself.

8.8.7. Commands

ID	Name	Direction	Response	Access	Conformance
0x01	**ModifyEnabledAlarms**				X