INTERNATIONAL STANDARD

ISO/IEC 23005-2

First edition
2011-08-01

Information technology — Media context and control —

Part 2: Control information

Technologies de l'information — Contrôle et contexte de supports —

Partie 2: Informations de contrôle

Reference number
ISO/IEC 23005-2:2011(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

ISO/IEC 23005-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 23005 consists of the following parts, under the general title *Information technology — Media context and control*:

— *Part 1: Architecture*

— *Part 2: Control information*

— *Part 3: Sensory information*

— *Part 4: Virtual world object characteristics*

— *Part 5: Data formats for interaction devices*

— *Part 6: Common types and tools*

— *Part 7: Conformance and reference software*

Introduction

ISO/IEC 23005 (MPEG-V) provides an architecture and specifies associated information representations to enable interoperability between virtual worlds, e.g. digital content provider of a virtual world, gaming (serious), simulation, DVD, and the real world, e.g. sensors, actuators, vision and rendering, robotics (e.g. for revalidation), (support for) independent living, social and welfare systems, banking, insurance, travel, real estate, rights management and many others.

Virtual worlds (often referred to as 3D3C for 3D visualization and navigation and the 3Cs of Community, Creation and Commerce) integrate existing and emerging media technologies (e.g. instant messaging, video, 3D, VR, AI, chat, voice, etc.) that allow for the support of existing and the development of new kinds of social networks. The emergence of virtual worlds as platforms for social networking is recognized by businesses as an important issue for at least two reasons:

1) it offers the power to reshape the way companies interact with their environments (markets, customers, suppliers, creators, stakeholders, etc.) in a fashion comparable to the Internet;

2) it allows for the development of new (breakthrough) business models, services, applications and devices.

Each virtual world, however, has a different culture and audience making use of these specific worlds for a variety of reasons. These differences in existing Metaverses permit users to have unique experiences. Resistance to real-world commercial encroachment still exists in many virtual worlds, where users primarily seek an escape from real life. Hence, marketers should get to know a virtual world beforehand and the rules that govern each individual universe.

Although realistic experiences have been achieved via devices such as 3D audio/visual devices, it is hard to realize sensory effects only with presentation of audiovisual contents. The addition of sensory effects leads to even more realistic experiences in the consumption of audiovisual contents. This will lead to the application of new media for enhanced experiences of users in a more realistic sense.

Such new media will benefit from the standardization of control and sensory information which consists of sensory effect metadata, sensory device capabilities/commands, user sensory preferences, and various delivery formats. The MPEG-V architecture can be applicable for various business models for which audiovisual contents can be associated with sensory effects that need to be rendered on appropriate sensory devices.

This part of ISO/IEC 23005 contains the tools of the control information for the media. It addresses the normative aspects of the control information including device capability description, user preference information, and also illustrates some non-normative examples.

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

ISO and the IEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured ISO and the IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and the IEC. Information may be obtained from the companies listed in Annex B.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified in Annex B. ISO and the IEC shall not be held responsible for identifying any or all such patent rights.

Information technology — Media context and control —

Part 2:
Control information

1 Scope

This part of ISO/IEC 23005 specifies syntax and semantics of the tools required to provide interoperability in controlling devices in real as well as virtual worlds. In Figure 1, the scope of this part of ISO/IEC 23005 with tools defined in this part of ISO/IEC 23005 is shown. The adaptation engine (RV or VR engine), which is not within the scope of standardization, takes five inputs [sensory effects (SE), user's sensory effect preferences (USEP), sensory devices capabilities (SDC), sensor capability (SC), and sensed information (SI)] and outputs sensory devices commands (SDC) and/or sensed information (SI) to control the devices in real world or virtual world objects. The scope of this part of ISO/IEC 23005 covers the interfaces between the adaptation engine and the capability descriptions of actuators/sensors in the real world and the user's sensory preference information, which characterize devices and users, so that appropriate information to control devices (actuators and sensors) can be generated. In other words, user's sensory preferences, sensory device capabilities, and sensor capabilities are within the scope of this part of ISO/IEC 23005.

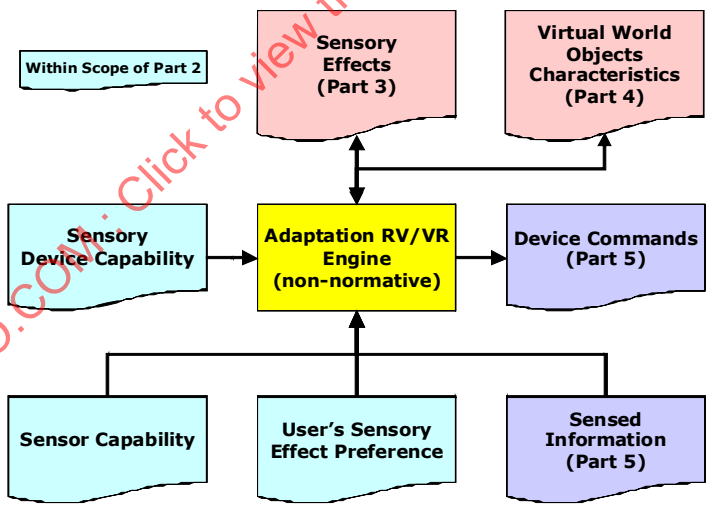

Figure 1 — Scope of the Control Information

2 Normative references

The following referenced documents are indispensable the application of this document. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15938-5:2003, *Information technology — Multimedia content description interface — Part 5: Multimedia description schemes*

ISO/IEC 23005-6, *Information technology — Media context and control — Part 6: Common types and tools*

ISO/IEC 21000-7, *Information technology — Multimedia framework (MPEG-21) — Part 7: Digital Item Adaptation*

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO/IEC 23005-6 apply.

3.1 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

DIA: Digital Item Adaptation (see ISO/IEC 21000-7)

MPEG-21: multimedia framework (ISO/IEC 21000-5)

XML: Extensible Markup Language (see XML)

4 Control information description language

4.1 Introduction

This Clause describes basic structure of the tools in this part of ISO/IEC 23005 in the form of control information description language including the schema wrapper conventions, basic data types, root element, and top-level elements.

4.2 Schema wrapper conventions

The Syntax defined in this part of ISO/IEC 23005 assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:dia="urn:mpeg:mpeg21:2003:01-DIA-
NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS" xmlns:cidl="urn:mpeg:mpeg-
v:2010:01-CIDL-NS" targetNamespace="urn:mpeg:mpeg-v:2010:01-CIDL-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-x" id="MPEG-V-CIDL.xsd">
    <import namespace="urn:mpeg:mpeg7:schema:2004" schemaLocation="
http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
7_schema_files/mpeg7-v2.xsd"/>
    <import namespace="urn:mpeg:mpeg21:2003:01-DIA-NS" schemaLocation="
http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
21_schema_files/dia-2nd/UED-2nd.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-CT-NS"
schemaLocation="CommonXSD.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-DCDV-NS"
schemaLocation="DCDV.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-SCDV-NS"
schemaLocation="SCDV.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-SEPV-NS"
schemaLocation="SEPV.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

4.3 Root element and top-level tools

4.3.1 Introduction

This Subclause specifies the root element and the top-level tools which can follow root element in control information. The root element is the only element which can appear as the topmost element when the control information specified in this part of ISO/IEC 23005 is instantiated. The top-level tools are defined as the elements which are allowed to appear as the topmost element within the root element.

4.3.2 Syntax

```
<!-- ################################################ -->
<!--  Root Element                                    -->
<!-- ################################################ -->
<element name="ControlInfo" type="cidl:ControlInfoType"/>

<complexType name="ControlInfoType">
    <sequence>
        <element name="SensoryDeviceCapabilityList"
            type="cidl:SensoryDeviceCapabilityListType" minOccurs="0"/>
        <element name="SensorDeviceCapabilityList"
            type="cidl:SensorDeviceCapabilityListType" minOccurs="0"/>
        <element name="UserSensoryPreferenceList"
            type="cidl:UserSensoryPreferenceListType" minOccurs="0"/>
    </sequence>
</complexType>

<complexType name="SensoryDeviceCapabilityListType">
    <sequence>
        <element name="SensoryDeviceCapability"
            type="cidl:SensoryDeviceCapabilityBaseType" maxOccurs="unbounded"/>
    </sequence>
</complexType>

<complexType name="SensorDeviceCapabilityListType">
    <sequence>
        <element name="SensorDeviceCapability"
            type="cidl:SensorCapabilityBaseType" maxOccurs="unbounded"/>
    </sequence>
</complexType>

<complexType name="UserSensoryPreferenceListType">
    <sequence>
        <element name="USPreference" type="cidl:UserSensoryPreferenceBaseType"
            maxOccurs="unbounded"/>
    </sequence>
</complexType>
```

4.3.3 Semantics

Semantics of the `ControlInfo` type:

Name	*Definition*
`ControlInfo`	The root element that serves as the topmost element in the control information description.
`ControlInfoType`	The root type provides basic structure that the control information description should follow through the root element.
`SensoryDeviceCapabilityList`	Optional wrapper element that serves as the placeholder for the list of sensory device capability descriptions.
`SensorDeviceCapabilityList`	Optional wrapper element that serves as the placeholder for the list of sensor device capability descriptions.
`UserSensoryPreferenceList`	Optional wrapper element that serves as the placeholder for the list of device user preference descriptions.
`SensoryDeviceCapabilityListType`	Wrapper element type which allows multiple occurrences of sensory device capability descriptions.
`SensoryDeviceCapability`	Specifies single description of sensory device capability description.
`SensoryDeviceCapabilityBaseType`	`SensoryDeviceCapabilityBaseType` shall extend `dia:TeminalCapabilityBaseType` as defined in ISO/IEC 21000-7 and provides a base abstract type for a subset of types defined as part of the sensory device capability metadata types.
`SensorDeviceCapabilityListType`	Wrapper element type which allows multiple occurrences of sensor device capability descriptions.
`SensorDeviceCapability`	Specifies single description of sensor device capability description.
`SensorCapabilityBaseType`	`SensorCapabilityBaseType` shall extend `dia:TeminalCapabilityBaseType` as defined in ISO/IEC 21000-7 and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types.
`UserSensoryPreferenceListType`	Wrapper element type which allows multiple occurrences of user preference descriptions on sensory effects.
`USPreference`	Specifies single description of user preference description on sensory effect.
`UserSensoryPreferenceBaseType`	`UserSensoryPreferenceBaseType` shall extend `dia:UserCharacteristicBaseType` as defined in ISO/IEC 21000-7 and provides a base abstract type for a subset of types defined as part of the sensory device capability metadata types.

4.3.4 Examples

The followings are some examples of the `ControlInfo` type:

The following example shows an instantiation of `SensoryDeviceCapabilityList`. The `SensoryDeviceCapabilityList` allows multiple occurrences of `SensoryDeviceCapability` elements. For the details of `SensoryDeviceCapability` elements, please see the examples of individual sensory device capability types.

```
<cidl:ControlInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SCDV-NS SCDV.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:cidl="urn:mpeg:mpeg-
v:2010:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-v:2010:01-DCDV-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2010:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-v:2010:01-
SEPV-NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS">
    <cidl:SensoryDeviceCapabilityList>
        <cidl:SensoryDeviceCapability xsi:type="dcdv:LightCapabilityType">
            . . .
        </cidl:SensoryDeviceCapability>
            . . .
    </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

The following example shows an instantiation of `SensorDeviceCapabilityList`. The `SensorDeviceCapabilityList` allows multiple occurrences of `SensorDeviceCapability` elements. For the details of `SensorDeviceCapability` elements, please see the examples of individual sensor device capability types.

```
<cidl:ControlInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SCDV-NS SCDV.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:cidl="urn:mpeg:mpeg-
v:2010:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-v:2010:01-DCDV-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2010:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-v:2010:01-
SEPV-NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS">
    <cidl:SensorDeviceCapabilityList>
        <cidl:SensorDeviceCapability
            xsi:type="scdv:AmbientNoiseSensorCapabilityType">
            . . .
        </cidl:SensorDeviceCapability>
        . . .
    </cidl:SensorDeviceCapabilityList>
</cidl:ControlInfo>
```

The following example shows an instantiation of `UserSensoryPreferenceList`. The `UserSensoryPreferenceList` allows multiple occurrences of `USPreference` elements. For the details of `USPreference`, please see the examples of user's sensory preference on individual sensory effects.

```
<cidl:ControlInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SCDV-NS SCDV.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:cidl="urn:mpeg:mpeg-
v:2010:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-v:2010:01-DCDV-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2010:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-v:2010:01-
SEPV-NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS">
    <cidl:UserSensoryPreferenceList>
        <cidl:USPreference xsi:type="cid:CoolingPrefType">
            . . .
        </cidl:USPreference>
        . . .
```

```
    </cidl:UserSensoryPreferenceList>
</cidl:ControlInfo>
```

4.4 Sensory Device Capability Description

4.4.1 Introduction

This Subclause specifies tools for describing device capabilites of sensory devices. The following Subclause defines an abstract complex type of SensoryDeviceCapabilityBaseType, which the device capability description of individual sensory device should inherit.

4.4.2 Reference Coordinate System

The origin of the reference coordinate for sensory devices is located at the position of the user. Each axis is defined as follows. X-axis is in the direction of the right hand side of the user facing the screen. Y-axis is in the reverse direction of gravity. Z-axis is in the direction of the user's facing the screen. The x-, y-, and z-axis are depicted in Figure 2.

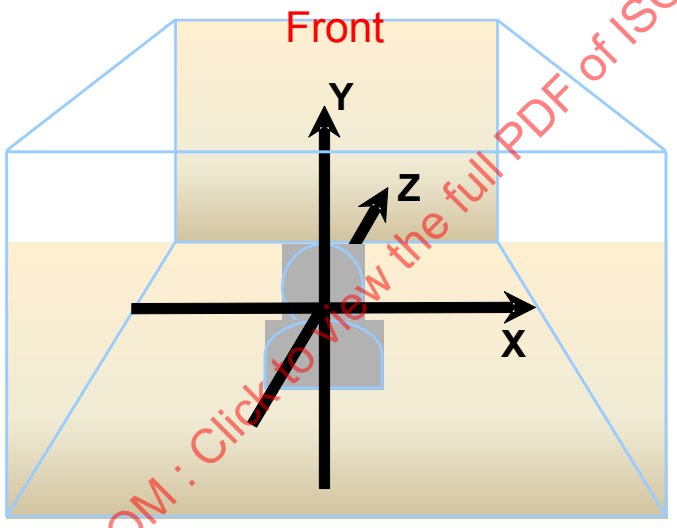

Figure 2 — Reference Coordinate System for Sensory Devices

4.4.3 Sensory Device capability base type

4.4.3.1 Syntax

```
<!-- ################################################ -->
<!--  Sensory Device capability base type             -->
<!-- ################################################ -->
<complexType name="SensoryDeviceCapabilityBaseType" abstract="true">
   <complexContent>
      <extension base="dia:TerminalCapabilityBaseType">
         <attributeGroup ref="cidl:sensoryDeviceCapabilityAttributes"/>
      </extension>
   </complexContent>
</complexType>
```

4.4.3.2 Semantics

Semantics of the `SensoryDeviceCapabilityBaseType` type:

Name	*Definition*
`SensoryDeviceCapabilityBaseType`	`SensoryDeviceCapabilityBaseType` shall extend `dia:TeminalCapabilityBaseType` as defined in ISO/IEC 21000-7 and provides a base abstract type for a subset of types defined as part of the sensory device capability metadata types.
`sensoryDeviceCapabilityAttributes`	Describes a group of attributes for the device capabilities.

4.4.4 Sensory Device capability base attributes

4.4.4.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of Sensory Device Capability Attributes                  -->
<!-- ################################################ -->
<attributeGroup name="sensoryDeviceCapabilityAttributes">
   <attribute name="zerothOrderDelayTime" type="nonNegativeInteger"
      use="optional"/>
   <attribute name="firstOrderDelayTime" type="nonNegativeInteger"
      use="optional"/>
   <attribute name="locator" type="mpeg7:termReferenceType" use="optional"/>
</attributeGroup>
```

4.4.4.2 Semantics

Semantics of the `sensoryDeviceCapabilityAttributes` type:

Name	*Definition*
`sensoryDeviceCapabilityAttributes`	Describes a group of attributes for the sensory device capabilities.
`zerothOrderDelayTime`	Describes required preparation time of a sensory device to be activated since it receives a command in the unit of millisecond (ms).
`firstOrderDelayTime`	Describes the delay time for a device to reach the target intensity since it receives a command and is activated in the unit of millisecond (ms).
`locator`	Describes the position of the device from the user's perspective according to the x-, y-, and z-axis as a reference to the `LocationCS` as defined in Annex 2.3 of ISO/IEC 23005-6.

4.4.4.3 Examples

The following example shows a use of `sensoryDeviceCapabilityAttributes`, which describes that a sensory device, specified by the identifier value of *ldc1*, of "*specific_sensory_device_capability_type*" requires preparation time of 0 ms to start, and 1 ms to reach target intensity, and is located at the left side according to the position model defined in Annex 2.3 of ISO/IEC 23005-6.

```
<cidl:SensoryDeviceCapability
xsi:type="dcdv:specific_sensory_device_capability_type"   firstOrderDelayTime="0"
zerothOrderDelayTime="1"   id="ldc1"   location="urn:mpeg:mpeg-v:01-SI-PositionCS-
NS:left"/>
```

4.5 Sensor Capability Description

4.5.1 Introduction

This Clause specifies tools for describing Sensor capability of individual sensors. The following Subclause defines the global coordinate for sensors which depends on the real world environment of user to determine the location of the sensors. An abstract complex type of SensorCapabilityBaseType, which the sensor capability description of individual device should inherit, is defined in the following Subclause.

4.5.2 Global coordinate for sensors

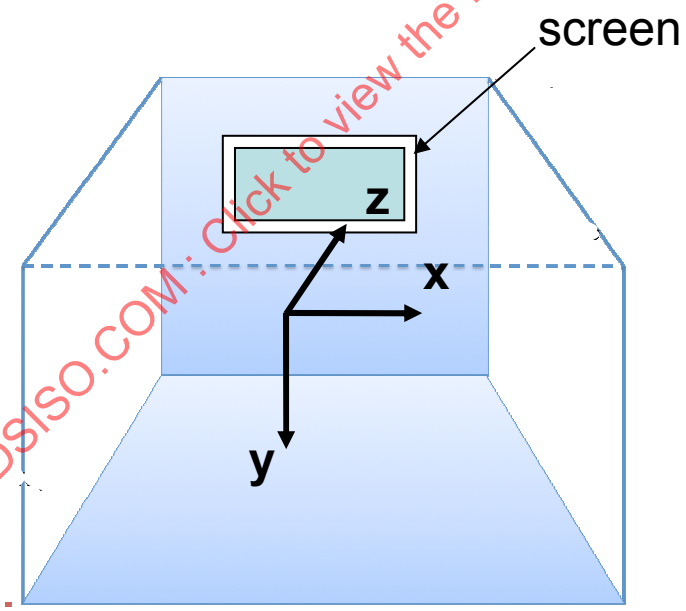

Figure 3 — Global coordinate for sensors

The origin of the global coordinate for sensors is located at the position of the user adapting the right handed coordinate system. Each axis is defined as follows. Y-axis is in the direction of gravity. X-axis is in the direction of the top right corner of the screen. Z-axis is in the opposite direction of the user's position. The x-, y-, and z-axis are depicted in Figure 3.

4.5.3 Sensor capability base type

4.5.3.1 Syntax

```
<!-- ################################################ -->
<!--  Sensor Capability base type                     -->
<!-- ################################################ -->
<complexType name="SensorCapabilityBaseType" abstract="true">
   <complexContent>
      <extension base="dia:TerminalCapabilityBaseType">
         <sequence>
            <element name="Accuracy" type="cidl:AccuracyType" minOccurs="0"/>
         </sequence>
         <attributeGroup ref="cidl:sensorCapabilityBaseAttributes"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="AccuracyType" abstract="true"/>

<complexType name="PercentAccuracy">
   <complexContent>
      <extension base="cidl:AccuracyType">
         <attribute name="value" type="mpeg7:zeroToOneType"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="ValueAccuracy">
   <complexContent>
      <extension base="cidl:AccuracyType">
         <attribute name="value" type="float"/>
      </extension>
   </complexContent>
</complexType>
```

4.5.3.2 Semantics

Semantics of the `SensorCapabilityBaseType`:

Name	*Definition*
`SensorCapabilityBaseType`	`SensorCapabilityBaseType` shall extend `dia:TeminalCapabilityBaseType` as defined in ISO/IEC 21000-7 and provides a base abstract type for a subset of types defined as part of the sensor device capability metadata types.
`Accuracy`	Describes the degree of closeness of a measured quantity to its actual value in `AccuracyType`.
`sensorCapabilityBase Attributes`	Describes a group of attributes for the sensor capabilities.

Semantics of the AccuracyType:

Name	*Definition*
AccuracyType	Becomes a parent type providing a choice of describing the accuracy in either relative value or absolute value.
PercentAccuracy	Describes the degree of closeness of a measured quantity to its actual value in a relative way using a value ranging from 0 to 1.0.
value	Provides an actual value in a relative way for accuracy where value 0 means 0 % accuracy and value 1.0 means 100 % accuracy. It shall be a zeroToOneType type as defined in ISO/IEC 15938-5:2003.
ValueAccuracy	Describes the degree of closeness of a measured quantity to its actual value in an absolute value of given unit.
value	Provides an actual value in an absolute way, where the value means the possible range of error as (-value, +value) of given unit.

4.5.3.3 Examples

For examples of using SensorCapabilityBaseType please see the examples provided by the individual sensor device capability types.

4.5.4 Sensor capability base attributes

4.5.4.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of Sensor Capability Base Attributes -->
<!-- ################################################ -->
<attributeGroup name="sensorCapabilityBaseAttributes">
   <attribute name="unit" type="mpegvct:unitType" use="optional"/>
   <attribute name="maxValue" type="float" use="optional"/>
   <attribute name="minValue" type="float" use="optional"/>
   <attribute name="offset" type="float" use="optional"/>
   <attribute name="numOfLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="sensitivity" type="float" use="optional"/>
   <attribute name="SNR" type="float" use="optional"/>
</attributeGroup>
```

4.5.4.2 Semantics

Semantics of the `SensorCapabilityBaseAttributes`:

Name	*Definition*
`sensorCapabilityBase Attributes`	Describes a group of attributes for the sensor capabilities.
`unit`	Describes the unit of the sensor's measuring value. Specifies the unit of the sensor's measuring value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if a unit other than the default unit specified in the semantics of the `maxValue` and `minValue` is used for the values of `maxValue` and `minValue` are used.
`maxValue`	Describes the maximum value that the sensor can perceive. The terms will be different according to the individual sensor type.
`minValue`	Describes the minimum value that the sensor can perceive. The terms will be different according to the individual sensor type.
`offset`	Describes the number of value locations added to a base value in order to get to a specific absolute value.
`numOfLevels`	Describes the number of value levels that the sensor can perceive in between maximum and minimum value. EXAMPLE The value 5 means the sensor can perceive 5 steps from minValue to maxValue.
`sensitivity`	Describes the minimum magnitude of input signal required to produce a specified output signal in given unit.
`SNR`	Describes the ratio of a signal power to the noise power corrupting the signal.

4.5.4.3 Examples

The following example shows a use of `SensorCapabilityBaseAttributes`. It shows that an arbitrary sensor device of type `any_specific_sensor_device_capability_type` has an id of "ans01" with maxValue of 100, minValue of 10, 20 levels, offset of -3, sensitivity of 0.8, and SNR of 99 dB. It also shows that the measuring unit of the specified sensor device is dB.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:any_specific_sensor_device_capability_type"                id="ans01"
maxValue="100"   minValue="10"   numOfLevels="20"   offset="-3"   sensitivity="0.8"
SNR="99" unit="dB"/>
```

4.6 User's Sensory Preference Description

4.6.1 Introduction

This Subclause specifies tools for describing preferences of individual users regarding the sensory experience. The following Subclauses define an abstract complex type of UserSensoryPreferenceBaseType, which the user preferences on each individual type of sensory experience should inherit.

4.6.2 UserSensoryPreference base type

4.6.2.1 Syntax

```
<!-- ################################################ -->
<!--  UserSensory Preference base type                -->
<!-- ################################################ -->
<complexType name="UserSensoryPreferenceBaseType" abstract="true">
   <complexContent>
      <extension base="dia:UserCharacteristicBaseType">
         <attributeGroup ref="cidl:userSensoryPrefBaseAttributes"/>
      </extension>
   </complexContent>
</complexType>
```

4.6.2.2 Semantics

Semantics of the `UserSensoryPreferenceBaseType` type:

Name	*Definition*
`UserSensoryPreference BaseType`	`UserSensoryPreferenceBaseType` shall extend `dia:UserCharacteristicBaseType` as defined in ISO/IEC 21000-7 and provides a base abstract type for a subset of types defined as part of the sensory device capability metadata types.
`userSensoryPrefBase Attributes`	Describes a group of common attributes for the describing user preferences on sensory experience.

4.6.2.3 Examples

For the examples of `UserSensoryPreferenceBaseType`, please see the examples of preferences on individual sensory effect type.

4.6.3 User sensory preference base attributes

4.6.3.1 Syntax

```
<!-- ################################################ -->
<!--  User Sensory Preference Base Attributes         -->
<!-- ################################################ -->
<attributeGroup name="userSensoryPrefBaseAttributes">
   <attribute name="adaptationMode" type="cidl:adaptationModeType"
      use="optional"/>
   <attribute name="activate" type="boolean" use="optional"/>
</attributeGroup>
```

```
<!--  User Preference of Adaptation Mode Types     -->
<simpleType name="adaptationModeType">
   <restriction base="string">
      <enumeration value="strict"/>
      <enumeration value="scalable"/>
   </restriction>
</simpleType>
```

4.6.3.2 Semantics

Semantics of the `userSensoryPrefBaseAttributes` type:

Name	*Definition*
`userSensoryPrefBase Attributes`	Describes a group of common attributes for the describing user preferences on sensory experience.
`adaptationMode`	Describes the user's preference on the adaptation method for the sensory effect. EXAMPLE The value "strict" means the user prefer to render sensory effect exactly as described. Otherwise the value "scalable" means to render sensory effect with scaled intensity according to the device capacity.
`activate`	Describes whether the effect shall be activated. A value of `true` means the effect shall be activated and `false` means the effect shall be deactivated.
`adaptationModeType`	Tool for describing the adaptation mode with enumeration set. When its value is `strict`, it means that when the input value is out of range, the output should be equal to the maximum value that the device is able to operate. When its value is `scalable`, it means that the output shall be linearly scaled into the range that the device can operate.

4.6.3.3 Examples

For the examples of `userSensoryPrefBaseAttributes`, please see the examples of preferences on individual sensory effect type.

5 Device capability description vocabulary

5.1 Introduction

This Clause describes syntax and semantics of the device capability description vocabulary to implement description of capability of individual devices.

5.2 Schema wrapper conventions

The Syntax defined in this Clause assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-
CT-NS" xmlns:cidl="urn:mpeg:mpeg-v:2010:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-
v:2010:01-DCDV-NS" targetNamespace="urn:mpeg:mpeg-v:2010:01-DCDV-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-x" id="MPEG-V-DCDV.xsd">
    <import namespace="urn:mpeg:mpeg7:schema:2004"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
7_schema_files/mpeg7-v2.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-CIDL-NS"
schemaLocation="CIDL.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-CT-NS"
schemaLocation="CommonXSD.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

5.3 Light capability type

5.3.1 Syntax

```
<!-- ################################################ -->
<!-- Light capability type                            -->
<!-- ################################################ -->
<complexType name="LightCapabilityType">
    <complexContent>
        <extension base="cidl:SensoryDeviceCapabilityBaseType">
            <sequence>
                <element name="Color" type="mpegvct:colorType" minOccurs="0"
                    maxOccurs="unbounded"/>
            </sequence>
            <attribute name="unit" type="mpegvct:unitType" use="optional"/>
            <attribute name="maxIntensity" type="nonNegativeInteger"
                use="optional"/>
            <attribute name="numOfLightLevels" type="nonNegativeInteger"
                use="optional"/>
        </extension>
    </complexContent>
</complexType>
```

5.3.2 Semantics

Semantics of the `LightCapabilityType` type:

Name	*Definition*
`LightCapabilityType`	Tool for describing a light capability.
`unit`	Specifies the unit of the maxIntensity, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6.
`maxIntensity`	Describes the maximum intensity that the lighting device can provide in terms of LUX.
`numOfLightLevels`	Describes the number of intensity levels that the device can provide in between maximum and minimum intensity of light.
`Color`	Describes the list of colors which the lighting device can provide as a reference to a classification scheme term or as RGB value. A CS that may be used for this purpose is the `ColorCS` defined in A.2.2 of ISO/IEC 23005-6. EXAMPLE `urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue` would describe the color Alice blue.

5.3.3 Examples

This example shows the description of a light capability with the following semantics. The light identifier is "`light1`". The maximum intensity of the light is 300 lux. There are 10 light levels between maximum and minimum intensity. The location of the light is the right side according to the position model described in Figure 3 of ISO/IEC 23005-3. The colors that can be displayed by the light are "white", "red", "blue", and "green" from the classification scheme described in A.2.2. of ISO/IEC 23005-6.

```
<cidl:ControlInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SCDV-NS SCDV.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:cidl="urn:mpeg:mpeg-
v:2010:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-v:2010:01-DCDV-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2010:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-v:2010:01-
SEPV-NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS">
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:LightCapabilityType"
       id="light1" unit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:lux"
       maxIntensity="300" numOfLightLevels="10" locator="urn:mpeg:mpeg-v:01-SI-
       PositionCS-NS:right">
         <dcdv:Color>
         :mpeg:mpeg-v:01-SI-ColorCS-NS:white
         </dcdv:Color>
         <dcdv:Color>
         :mpeg:mpeg-v:01-SI-ColorCS-NS:red
         </dcdv:Color>
         <dcdv:Color>
         :mpeg:mpeg-v:01-SI-ColorCS-NS:blue
         </dcdv:Color>
         <dcdv:Color>
         :mpeg:mpeg-v:01-SI-ColorCS-NS:green
         </dcdv:Color>
      </cidl:SensoryDeviceCapability>
```

```
    </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.4 Flash capability type

5.4.1 Syntax

```
<!-- ################################################ -->
<!--  Flash capability type                           -->
<!-- ################################################ -->
<complexType name="FlashCapabilityType">
   <complexContent>
      <extension base="dcdv:LightCapabilityType">
         <attribute name="maxFrequency" type="positiveInteger" use="optional"/>
         <attribute name="numOfFreqLevels" type="nonNegativeInteger"
            use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.4.2 Semantics

Semantics of the `FlashCapabilityType` type:

Name	*Definition*
`FlashCapabilityType`	Tool for describing a flash capability. It is extended from the light capability type.
`maxFrequency`	Describes the maximum number of flickering in times per second. EXAMPLE The value 10 means the device can flicker 10 times for each second.
`maxIntensity`	Describes the maximum intensity that the flash device can provide in terms of LUX.
`unit`	Specifies the unit of the maxIntensity, if a unit other than the default unit is used, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6.
`numOfFreqLevels`	Describes the number of frequency levels that the device can provide in between maximum and minimum frequency.
`numOfLightLevels`	Describes the number of intensity levels that the device can provide in between maximum and minimum intensity of light.

5.4.3 Examples

This example shows the description of a flash light capability with the following semantics. The flash light identifier is “flash1”. The maximum frequency of the flash light is 50 times per second. There are 10 levels between maximum and minimum frequency of the flash light. The location of the flash light is the left side according to the position model described in Figure 3 of ISO/IEC 23005-3.

```
<cidl:ControlInfo>
  <cidl:SensoryDeviceCapabilityList>
    <cidl:SensoryDeviceCapability xsi:type="dcdv:FlashCapabilityType" id="flash1"
      maxFrequency="50" numOfFreqLevels="10"
      unit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:lux" maxIntensity="300"
      numOfLightLevels="10" location="urn:mpeg:mpeg-v:01-SI-PositionCS-NS:left"/>
  </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.5 Heating capability type

5.5.1 Syntax

```
<!-- ################################################ -->
<!--  Heating capability type                         -->
<!-- ################################################ -->
<complexType name="HeatingCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <attribute name="maxIntensity" type="nonNegativeInteger"
            use="optional"/>
         <attribute name="minIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
         <attribute name="numOfLevels" type="nonNegativeInteger"
            use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.5.2 Semantics

Semantics of the `HeatingCapabilityType` type:

Name	*Definition*
`HeatingCapabilityType`	Tool for describing the capability of a device which can increae the room temperature.
`maxIntensity`	Describes the highest temperature that the heating device can provide in terms of Celsius (or Fahrenheit).
`minIntensity`	Describes the lowest temperature that the heating device can provide in terms of Celsius (or Fahrenheit).
`unit`	Specifies the unit of the intensity, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6 (it shall be a reference to either Celsius or Fahrenheit.) If the unit is not specified, the default unit is Celsius.
`numOfLevels`	Describes the number of temperature levels that the device can provide in between maximum and minimum temperature.

5.5.3 Examples

This example shows the description of a heating capability with the following semantics. The heating device identifier is “heater1”. The maximum intensity of the heating device is 40 degrees Celsius, and the minimum intensity is 20 degrees Celsius. This specified device can support 40 levels in controlling the intensity. This device takes 10 milliseconds to start and 20 milliseconds to reach the target intensity. The location of the heating device is the left side according to the position model described in Figure 3 of ISO/IEC 23005-3.

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:HeatingCapabilityType"
      id="heater1" zerothOrderDelayTime="10" firstOrderDelayTime="20"
      maxIntensity="40" minIntensity="20" numOfLevels="40"
      locator="urn:mpeg:mpeg-v:01-SI-PositionCS-NS:left"/>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.6 Cooling capability type

5.6.1 Syntax

```
<!-- ################################################ -->
<!--  Cooling capability type                         -->
<!-- ################################################ -->
<complexType name="CoolingCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <attribute name="minIntensity" type="integer" use="optional"/>
         <attribute name="maxIntensity" type="nonNegativeInteger"
            use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
         <attribute name="numOfLevels" type="nonNegativeInteger"
            use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.6.2 Semantics

Semantics of the `CoolingCapabilityType` type:

Name	*Definition*
`CoolingCapabilityType`	Tool for describing the capability of a device which can decrease the room temperature.
`maxIntensity`	Describes the lowest temperature that the cooling device can provide in terms of Celsius.
`minIntensity`	Describes the highest temperature that the cooling device can provide in terms of Celsius.
`unit`	Specifies the unit of the intensity, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6 (it shall be a reference to either Celsius or Fahrenheit.) If the unit is not specified, the default unit is Celsius.
`numOfLevels`	Describes the number of temperature levels that the device can provide in between maximum and minimum temperature.

5.6.3 Examples

This example shows the description of a heating capability with the following semantics. The heating device identifier is “cooler1”. The maximum intensity of the cooling device is 15 degrees Celsius, and the minimum intensity is 30 degrees Celsius. This specified device can support 30 levels in controlling the intensity. This device takes 10 milliseconds to start and 30 milliseconds to reach the target intensity. The location of the heating device is the right side according to the position model described in Figure 3 of ISO/IEC 23005-3.

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:CoolingCapabilityType"
      id="cooler1" zerothOrderDelayTime="10" firstOrderDelayTime="30"
      maxIntensity="15" minIntensity="30" numOfLevels="30"
      locator="urn:mpeg:mpeg-v:01-SI-PositionCS-NS:right"/>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.7 Wind capability type

5.7.1 Syntax

```
<!-- ################################################ -->
<!-- Wind type                                        -->
<!-- ################################################ -->
<complexType name="WindCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <attribute name="maxWindSpeed" type="nonNegativeInteger"
            use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
```

```
            <attribute name="numOfLevels" type="nonNegativeInteger"
               use="optional"/>
         </extension>
      </complexContent>
</complexType>
```

5.7.2 Semantics

Semantics of the `WindCapabilityType` type:

Name	*Definition*
`WindCapabilityType`	Tool for describing a wind capability.
`maxWindSpeed`	Describes the maximum wind speed that the fan can provide in terms of Meter per second.
`unit`	Specifies the unit of the intensity, if a unit other than the default unit specified in the semantics of the maxWindSpeed is used, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6.
`numOfLevels`	Describes the number of wind speed levels that the device can provide in between maximum and minimum speed.

5.7.3 Examples

This example shows the description of a wind device capability with the following semantics. The wind device identifier is “fan01”. The maximum wind speed of the wind device (possibly a fan) is 30 meter per second. This specified device can support 5 levels in controlling the wind speed. This device takes 10 milliseconds to start and 10 milliseconds to reach the target intensity. The location of the heating device is the center according to the position model described in Figure 3 of ISO/IEC 23005-3.

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:WindCapabilityType"
      id="fan01" zerothOrderDelayTime="10" firstOrderDelayTime="10"
      maxWindSpeed="30" numOfLevels="5" locator="urn:mpeg:mpeg-v:01-SI-
      PositionCS-NS:center"/>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.8 Vibration capability type

5.8.1 Syntax

```
<!-- ################################################ -->
<!--  Vibration capability type                       -->
<!-- ################################################ -->
<complexType name="VibrationCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
```

```
            <attribute name="maxIntensity" type="nonNegativeInteger"
               use="optional"/>
            <attribute name="unit" type="mpegvct:unitType" use="optional"/>
            <attribute name="numOfLevels" type="nonNegativeInteger"
               use="optional"/>
         </extension>
      </complexContent>
</complexType>
```

5.8.2 Semantics

Semantics of the `VibrationCapabilityType` type:

Name	*Definition*
`VibrationCapabilityType`	Tool for describing a vibration capability.
`maxIntensity`	Describes the maximum intensity that the vibrator device can provide in terms of Richter magnitude.
`unit`	Specifies the unit of the intensity, if a unit other than the default unit specified in the semantics of the maxIntensity is used, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6.
`numOfLevels`	Describes the number of intensity levels that the device can provide in between zero and maximum intensity.

5.8.3 Examples

This example shows the description of a vibration device capability with the following semantics. The vibration device identifier is “vib001”. The maximum intensity of the vibration device is 4 Richter. This specified device can support 4 levels in controlling the intensity. This device takes 0 milliseconds to start and 10 milliseconds to reach the target intensity. The location of the heating device is the center side according to the position model described in Figure 3 of ISO/IEC 23005-3.

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:VibrationCapabilityType"
      id="vib001" zerothOrderDelayTime="0" firstOrderDelayTime="10"
      maxIntensity="4" numOfLevels="4" locator="urn:mpeg:mpeg-v:01-SI-
      PositionCS-NS:center"/>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.9 Scent capability type

5.9.1 Syntax

```
<!-- ################################################ -->
<!--  Scent capability type                           -->
<!-- ################################################ -->
<complexType name="ScentCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <sequence>
            <element name="Scent" type="mpeg7:termReferenceType" minOccurs="0"
               maxOccurs="unbounded"/>
         </sequence>
         <attribute name="maxIntensity" type="nonNegativeInteger"
               use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
         <attribute name="numOfLevels" type="nonNegativeInteger"
               use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.9.2 Semantics

Semantics of the `ScentCapabilityType` type:

Name	*Definition*
`ScentCapabilityType`	Tool for describing a scent capability.
`Scent`	Describes the list of scent that the perfumer can provide. The type of the scent shall be described using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. A CS that may be used for this purpose is the `ScentCS` defined in A.2.4 of ISO/IEC 23005-6.
`maxIntensity`	Describes the maximum intensity that the perfumer can provide in terms of ml/h.
`unit`	Specifies the unit of the intensity, if a unit other than the default unit specified in the semantics of the maxIntensity is used, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`numOfLevels`	Describes the number of intensity levels of the scent that the device can provide in between zero and maximum intensity.

5.9.3 Examples

This example shows the description of a scent device capability with the following semantics. The scent device identifier is “scent01”. The maximum intensity of the scent amount is 5 millilitres per hour with two levels of control. As this device takes 0 milliseconds to start and 0 milliseconds to reach the target intensity, it is not specified explicitly. The location of the scent device is the center side according to the position model described in Figure 3 of ISO/IEC 23005-3. The type of scent is rose according to the ScentCS specified in A2.4 of ISO/IEC 23005-6.

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:ScentCapabilityType"
      id="scent01" maxIntensity="5" numOfLevels="2" locator="urn:mpeg:mpeg-v:01-
      SI-PositionCS-NS:center">
         <dcdv:Scent>urn:mpeg:mpeg-v:01-SI-ScentCS-NS:rose</dcdv:Scent>
      </cidl:SensoryDeviceCapability>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.10 Fog capability type

5.10.1 Syntax

```
<!-- ################################################ -->
<!--  Fog capability type                             -->
<!-- ################################################ -->
<complexType name="FogCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <attribute name="maxIntensity" type="nonNegativeInteger"
            use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
         <attribute name="numOfLevels" type="nonNegativeInteger"
            use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.10.2 Semantics

Semantics of the `FogCapabilityType` type:

Name	*Definition*
`FogCapabilityType`	Tool for describing a fog capability.
`maxIntensity`	Describes the maximum intensity that the fog device can provide in terms of ml/h.
`unit`	Specifies the unit of the intensity, if a unit other than the default unit specified in the semantics of the maxIntensity is used, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`numOfLevels`	Describes the number of intensity levels of the fog that the device can provide in between zero and maximum intensity.

5.10.3 Examples

This example shows the description of a fog device capability with the following semantics. The fog device identifier is “fog11”. The maximum intensity of the fog amount is 100 millilitres per hour with five levels of control. This device takes 30 milliseconds to start and 100 milliseconds to reach the target intensity. The location of the scent device is the back side according to the position model described in Figure 3 of ISO/IEC 23005-3.

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:FogCapabilityType" id="fog11"
      zerothOrderDelayTime="30" firstOrderDelayTime="100" maxIntensity="100"
      numOfLevels="5" locator="urn:mpeg:mpeg-v:01-SI-PositionCS-NS:back"/>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.11 Sprayer capability type

5.11.1 Syntax

```
<!-- ################################################ -->
<!--  Sprayer capability type                         -->
<!-- ################################################ -->
<complexType name="SprayerCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <attribute name="sprayingType" type="mpeg7:termReferenceType"/>
         <attribute name="maxIntensity" type="nonNegativeInteger"
            use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
         <attribute name="numOfLevels" type="nonNegativeInteger"
            use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.11.2 Semantics

Semantics of the `SprayerCapabilityType` type:

Name	*Definition*
`SprayerCapabilityType`	Tool for describing a water sprayer capability.
`sprayingType`	Describes the type of the material that the sprayer can spray as a reference to a classification scheme term. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. A CS that may be used for this purpose is the `SprayingTypeCS` defined in A.2.7 of ISO/IEC 23005-6.
`maxIntensity`	Describes the maximum intensity that the water sprayer can provide in terms of ml/h.
`unit`	Specifies the unit of the intensity, if a unit other than the default unit specified in the semantics of the maxIntensity is used, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`numOfLevels`	Describes the number of intensity levels of the fog that the device can provide in between zero and maximum intensity.

5.11.3 Examples

This example shows the description of a sprayer device capability with the following semantics. The sprayer device identifier is “spryr00”. The maximum intensity of the spraying amount is 10 millilitres per hour with three levels of control. This device takes 5 milliseconds to start and 5 milliseconds to reach the target intensity. The location of the sprayer device is the midway side according to the position model described in Figure 3 of ISO/IEC 23005-3.

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:SprayerCapabilityType"
      id="spryr00" sprayingType="urn:mpeg:mpeg-v:01-SI-SprayingTypeCS-NS:water"
      zerothOrderDelayTime="5" firstOrderDelayTime="5" maxIntensity="10"
      numOfLevels="3" locator="urn:mpeg:mpeg-v:01-SI-PositionCS-NS:midway"/>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.12 Color correction capability type

5.12.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of Color Correction Type             -->
<!-- ################################################ -->
<complexType name="ColorCorrectionCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <attribute name="flag" type="boolean" use="optional" default="false"/>
      </extension>
   </complexContent>
</complexType>
```

5.12.2 Semantics

Semantics of the `ColorCorrectionCapabilityType` type:

Name	*Definition*
`ColorCorrectionCapabilityType`	Tool for describing if the given device has a color correction capability.
`flag`	Describes the existence of the color correction capability of the given device in terms of “true” and “false”.

5.12.3 Examples

This example shows the description of a color correction capability with the following semantics. Since the Flag is “true”, the device “tv1” is equipped with a capability of color correction.

```
<ControlInfo>
   <SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability
      xsi:type="dccv:ColorCorrectionCapabilityType" flag="true" id="tv1"/>
   </SensoryDeviceCapabilityList>
</ControlInfo>
```

5.13 Tactile capability type

5.13.1 Syntax

```
<!-- ################################################ -->
<!--  Tactile capability type                         -->
<!-- ################################################ -->
<complexType name="TactileCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <attribute name="intensityUnit" type="mpegvct:unitType"
            use="optional"/>
```

```
            <attribute name="maxValue" type="nonNegativeInteger" use="optional"/>
            <attribute name="minValue" type="nonNegativeInteger" use="optional"/>
            <attribute name="arraysizeX" type="integer"/>
            <attribute name="arraysizeY" type="integer"/>
            <attribute name="gapX" type="float" use="optional"/>
            <attribute name="gapY" type="float" use="optional"/>
            <attribute name="gapUnit" type="mpegvct:unitType" use="optional"/>
            <attribute name="maxUpdateRate" type="integer" use="optional"/>
            <attribute name="updateRateUnit" type="mpegvct:unitType"
               use="optional"/>
            <attribute name="actuatorType" type="mpeg7:termReferenceType"
               use="optional"/>
            <attribute name="numOfLevels" type="nonNegativeInteger"
               use="optional"/>
         </extension>
      </complexContent>
   </complexType>
```

5.13.2 Semantics

Semantics of the `TactileCapabilityType`:

Name	*Definition*
`TactileCapabilityType`	Tool for describing a tactile device capability.
`intensityUnit`	Specifies the unit of the intensity for maxValue and minValue, as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6. There is no default unit specified as the intensityUnit may vary depending on the type of the actuator used for the Tactile device. For example, when an electrotactile device is selected the unit can be mA. For a pneumatic tactile device, the unit may be either psi or Pa; for a vibrotactile device, the unit may be hz (frequency), or mm (amplitude); for a thermal display, the unit may be either Celsius or Fahrenheit.
`maxValue`	Describes the maximum intensity that a tactile device can drive in the unit specified by the intensityUnit attribute.
`minValue`	Describes the minimum intensity that a tactile device can drive in the unit specified by the intensityUnit attribute.
`arraysizeX`	Describes a number of actuators in X (horizontal) direction since a tactile device is formed as m-by-n array types. (integer)
`arraysizeY`	Describes a number of actuators in Y (vertical) direction since a tactile device is formed as m-by-n array types. (integer)
`gapX`	Describes the X directional gap space between actuators in a tactile device.(mm)
`gapY`	Describes the Y directional gap space between actuators in a tactile device.(mm)

Name	*Definition*
gapUnit	Specifies the unit of the description of gapX and gapY attributes as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than the default unit of mm is used. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in 7.6 of ISO/IEC 15938-5:2003.
maxUpdateRate	Describes a maximum update rate that a tactile device can drive.
updateRateUnit	Specifies the unit of the description of maxUpdateRate as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than the default unit of Hz is used. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in 7.6 of ISO/IEC 15938-5:2003.
actuatorType	Describes a type of tactile device (e.g. vibrating motor, electrotactile device, pneumatic device, piezoelectric device, thermal device, etc) as a reference to a classification scheme. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in 7.6 of ISO/IEC 15938-5:2003. A CS that may be used for this purpose is the TactileDisplayCS defined in A.2.11 of ISO/IEC 23005-6.
numOfLevels	Describes the number of intensity levels that a tactile device can drive.

5.13.3 Examples

The following is an example of the TactileCapabilityType to indicate that the specified device can display tactile information. This example shows the description of tactile device capabilities and its features. Among several tactile devices, a thermal device with 10-by-4 array is selected. In the array, each thermal element locates with a 5 mm gap and maximum temperature the thermal display can generate is 34 degree in Celsius and the minimum is 16 degree. Each thermal element drives 8 different levels and the temperature new temperature presented can be updated up to 10 times per second.

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:TactileCapabilityType"
      intensityUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:celsius" maxValue="34"
      minValue="16" arraysizeX="10" arraysizeY="4" gapX="5" gapY="5"
      maxUpdateRate="10" actuatorType="urn:mpeg:mpeg-v:01-CI-TactileDisplayCS-
      NS:thermal" numOfLevels="8"/>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.14 Kinesthetic capability type

5.14.1 Syntax

```
<!-- ################################################ -->
<!--  Kinesthetic capability type                     -->
<!-- ################################################ -->
<complexType name="KinestheticCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <sequence>
            <element name="MaximumForce" type="mpegvct:Float3DVectorType"/>
            <element name="MaximumTorque" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
            <element name="MaximumStiffness" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
            <element name="DOF" type="dcdv:DOFType"/>
            <element name="WorkSpace" type="dcdv:WorkSpaceType"/>
         </sequence>
         <attribute name="forceUnit" type="mpegvct:unitType" use="optional"/>
         <attribute name="torqueUnit" type="mpegvct:unitType" use="optional"/>
         <attribute name="stiffnessUnit" type="mpegvct:unitType"
            use="optional"/>
         <attribute name="numOfForceLevels" type="nonNegativeInteger"
            use="optional"/>
         <attribute name="numOfTorqueLevels" type="nonNegativeInteger"
            use="optional"/>
         <attribute name="numOfStiffnessLevels" type="nonNegativeInteger"
            use="optional"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="DOFType">
   <sequence>
      <element name="Tx" type="boolean"/>
      <element name="Ty" type="boolean"/>
      <element name="Tz" type="boolean"/>
      <element name="Rx" type="boolean"/>
      <element name="Ry" type="boolean"/>
      <element name="Rz" type="boolean"/>
   </sequence>
</complexType>

<complexType name="WorkSpaceType">
   <sequence>
      <element name="Width" type="float"/>
      <element name="Height" type="float"/>
      <element name="Depth" type="float"/>
      <element name="RotationX" type="float"/>
      <element name="RotationY" type="float"/>
      <element name="RotationZ" type="float"/>
   </sequence>
</complexType>
```

5.14.2 Semantics

Semantics of the `KinestheticCapabilityType`:

Name	*Definition*
`KinestheticCapabilityType`	Tool for describing a kinesthetic device capability.
`MaximumForce`	Describes the maximum force that the device can provide stably for each axis (N).
`MaximumTorque`	Describes the maximum torque referring maximum rotational force that the device can generate stably for each axis.(Nmm)
`MaximumStiffness`	Describes the maximum stiffness (rigidity) that the device can generate stably for each axis.(N/mm)
`DOF`	Describes the DOF (degree of freedom) of the device.
`WorkSpace`	Describes the workspace of the device. (e.g. Width x Height x Depth(mm), 3 angles(degree))
`forceUnit`	Specifies the unit of the description of `maximumForce` attribute as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than N(Newton) is used. 1N refers a force that produces an acceleration of 1 m/s^2 for 1 kg mass. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`torqueUnit`	Specifies the unit of the description of `maximumTorque` attribute as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than Nmm (Newton-millimeter) is used. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`stiffnessUnit`	Specifies the unit of the description of `maximumTorque` attribute as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than N/mm (Newton per millimeter) is used. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`numOfForceLevels`	Describes the number of intensity levels of force that the kinesthetic device can drive.
`numOfTorqueLevels`	Describes the number of intensity levels of torque that the kinesthetic device can drive.
`numOfStiffnessLevels`	Describes the number of intensity levels of stiffness that the kinesthetic device can drive.

Semantics of the DOFType:

Name	*Definition*
DOFType	Defines a degree of freedom that shows a kinesthetic device provides several single (independent) movements.
Tx	A Boolean values whether a kinesthetic device allows x directional independent translation or not.
Ty	A Boolean values whether a kinesthetic device allows y directional independent translation or not.
Tz	A Boolean values whether a kinesthetic device allows z directional independent translation or not.
Rx	A Boolean values whether a kinesthetic device allows x directional independent rotation or not.
Ry	A Boolean values whether a kinesthetic device allows y directional independent rotation or not.
Rz	A Boolean values whether a kinesthetic device allows z directional independent rotation or not.

Semantics of the workspaceType:

Name	*Definition*
WorkSpaceType	Defines ranges where a kinesthetic device can translate and rotate. According to DOF (degree of freedom), three translational values(width, height, and depth) in mm(millimeter) and three rotational values(roll, pitch and yaw) in degree are defined.
Width	Defines a maximum range in the unit of mm (millimeter) that a kinesthetic device can translate in x-axis.
Height	Defines a maximum range in the unit of mm (millimeter) that a kinesthetic device can translate in y-axis.
Depth	Defines a maximum range in the unit of mm (millimeter) that a kinesthetic device can translate in z-axis.
RotationX	Defines a maximum range that a kinesthetic device can rotate in x-axis, Θ(pitch).
RotationY	Defines a maximum range that a kinesthetic device can rotate in y-axis, Ψ(yaw).
RotationZ	Defines a maximum range that a kinesthetic device can rotate in z-axis, φ(roll).

5.14.3 Examples

The following is an example of the `KinestheticCapabilityType` to indicate that the specified kinesthetic device can display. This example shows the description of kinesthetic device capabilities. This 3DOF kinesthetic device can support maximum force F(3.3N, 2.1N, 2.7N) and maximum stiffness K(1.45N/mm, 2.5N/mm, 1.07N/mm) and it's workspace is 180mm(width), 130mm(height), and 80mm(depth).

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability xsi:type="dcdv:KinestheticCapabilityType"
      forceUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:Newton"
      torqueUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:Nmm"
      stiffnessUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:Npmm"
      numOfForceLevels="100" numOfTorqueLevels="100" numOfStiffnessLevels="100">
         <dcdv:MaximumForce>
            <mpegvct:X>3.3</mpegvct:X>
            <mpegvct:Y>2.1</mpegvct:Y>
            <mpegvct:Z>2.7</mpegvct:Z>
         </dcdv:MaximumForce>
         <dcdv:MaximumTorque>
            <mpegvct:X>1.0</mpegvct:X>
            <mpegvct:Y>1.0</mpegvct:Y>
            <mpegvct:Z>-1.0</mpegvct:Z>
         </dcdv:MaximumTorque>
         <dcdv:MaximumStiffness>
            <mpegvct:X>1.0</mpegvct:X>
            <mpegvct:Y>1.0</mpegvct:Y>
            <mpegvct:Z>-1.0</mpegvct:Z>
         </dcdv:MaximumStiffness>
         <dcdv:DOF>
            <dcdv:Tx>true</dcdv:Tx>
            <dcdv:Ty>true</dcdv:Ty>
            <dcdv:Tz>true</dcdv:Tz>
            <dcdv:Rx>false</dcdv:Rx>
            <dcdv:Ry>false</dcdv:Ry>
            <dcdv:Rz>false</dcdv:Rz>
         </dcdv:DOF>
         <dcdv:WorkSpace>
            <dcdv:Width>180</dcdv:Width>
            <dcdv:Height>130</dcdv:Height>
            <dcdv:Depth>80</dcdv:Depth>
            <dcdv:RotationX>0</dcdv:RotationX>
            <dcdv:RotationY>0</dcdv:RotationY>
            <dcdv:RotationZ>0</dcdv:RotationZ>
         </dcdv:WorkSpace>
      </cidl:SensoryDeviceCapability>
   </cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

5.15 RigidBodyMotion capability type

5.15.1 Syntax

```
<!-- ################################################ -->
<!--  Rigid Body Motion capability type               -->
<!-- ################################################ -->
<complexType name="RigidBodyMotionCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <sequence>
            <element name="MoveTowardCapability"
               type="dcdv:MoveTowardCapabilityType" minOccurs="0"/>
            <element name="InclineCapability" type="dcdv:InclineCapabilityType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>

<!-- ################################################ -->
<!--  MoveToward Capability type                      -->
<!-- ################################################ -->
<complexType name="MoveTowardCapabilityType">
   <attribute name="maxXDistance" type="float" use="optional"/>
   <attribute name="maxYDistance" type="float" use="optional"/>
   <attribute name="maxZDistance" type="float" use="optional"/>
   <attribute name="distanceUnit" type="mpegvct:unitType" use="optional"/>
   <attribute name="maxXSpeed" type="float" use="optional"/>
   <attribute name="maxYSpeed" type="float" use="optional"/>
   <attribute name="maxZSpeed" type="float" use="optional"/>
   <attribute name="speedUnit" type="mpegvct:unitType" use="optional"/>
   <attribute name="maxXAccel" type="float" use="optional"/>
   <attribute name="maxYAccel" type="float" use="optional"/>
   <attribute name="maxZAccel" type="float" use="optional"/>
   <attribute name="accelUnit" type="mpegvct:unitType" use="optional"/>
   <attribute name="xDistanceLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="yDistanceLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="zDistanceLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="xSpeedLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="ySpeedLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="zSpeedLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="xAccelLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="yAccelLevels" type="nonNegativeInteger" use="optional"/>
   <attribute name="zAccelLevels" type="nonNegativeInteger" use="optional"/>
</complexType>

<!-- ################################################ -->
<!--  Incline Capability type                         -->
<!-- ################################################ -->
<complexType name="InclineCapabilityType">
   <attribute name="maxPitchAngle" type="mpegvct:InclineAngleType"
use="optional"/>
   <attribute name="maxYawAngle" type="mpegvct:InclineAngleType"
use="optional"/>
   <attribute name="maxRollAngle" type="mpegvct:InclineAngleType"
use="optional"/>
   <attribute name="maxPitchSpeed" type="float" use="optional"/>
   <attribute name="maxYawSpeed" type="float" use="optional"/>
```

```
    <attribute name="maxRollSpeed" type="float" use="optional"/>
    <attribute name="speedUnit" type="mpegvct:unitType" use="optional"/>
    <attribute name="maxPitchAccel" type="float" use="optional"/>
    <attribute name="maxYawAccel" type="float" use="optional"/>
    <attribute name="maxRollAccel" type="float" use="optional"/>
    <attribute name="accelUnit" type="mpegvct:unitType" use="optional"/>
    <attribute name="pitchAngleLevels" type="nonNegativeInteger" use="optional"/>
    <attribute name="yawAngleLevels" type="nonNegativeInteger" use="optional"/>
    <attribute name="rollAngleLevels" type="nonNegativeInteger" use="optional"/>
    <attribute name="pitchSpeedLevels" type="nonNegativeInteger" use="optional"/>
    <attribute name="yawSpeedLevels" type="nonNegativeInteger" use="optional"/>
    <attribute name="rollSpeedLevels" type="nonNegativeInteger" use="optional"/>
    <attribute name="pitchAccelLevels" type="nonNegativeInteger" use="optional"/>
    <attribute name="yawAccelLevels" type="nonNegativeInteger" use="optional"/>
    <attribute name="rollAccelLevels" type="nonNegativeInteger" use="optional"/>
</complexType>
```

5.15.2 Semantics

Semantics of the `RigidBodyMotionCapabilityType` type:

Name	*Definition*
`RigidBodyMotionCapabilityType`	Tool for describing the capability of Rigid body motion effect.
`MoveTowardCapability`	Describes the capability for move toward motion effect.
`InclineCapability`	Describes the capability for Incline motion effect.

Semantics of the `MoveTowardCapabilityType` type:

Name	*Definition*
`MoveTowardCapability Type`	Tool for describing a capability on move toward motion effect.
`maxXDistance`	Describes the maximum distance on x-axis that the device can provide in terms of centimeter. EXAMPLE The value ‘10’ means the device can move maximum 10cm on x-axis. NOTE The value 0 means the device can’t provide x-axis movement.
`maxYDistance`	Describes the maximum distance on y-axis that the device can provide in terms of centimeter.
`maxZDistance`	Describes the maximum distance on z-axis that the device can provide in terms of centimeter.

Name	*Definition*
distanceUnit	Specifies the unit of the description of MaxXDistance, MaxYDistance, and MaxZDistance attributes as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than cm (centimeter) is used. These three attributes shall have the same unit. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in 7.6 of ISO/IEC 15938-5:2003.
maxXSpeed	Describes the maximum speed on x-axis that the device can provide in terms of centimeter per second.
maxYSpeed	Describes the maximum speed on y-axis that the device can provide in terms of centimeter per second.
maxZSpeed	Describes the maximum speed on z-axis that the device can provide in terms of centimeter per second.
speedUnit	Specifies the unit of the description of MaxXSpeed, MaxYSpeed, and MaxZSpeed attributes as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than cm/sec (centimeter per second) is used. These three attributes shall have the same unit. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in 7.6 of ISO/IEC 15938-5:2003.
maxXAccel	Describes the maximum acceleration on x-axis that the device can provide in terms of centimeter per square second.
maxYAccel	Describes the maximum acceleration on y-axis that the device can provide in terms of centimeter per square second.
maxZAccel	Describes the maximum acceleration on z-axis that the device can provide in terms of centimeter per second square.
accelUnit	Specifies the unit of the description of MaxXAccel, MaxYAccel, and MaxZAccel attributes as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than cm/sec^2 (centimeter per second square) is used. These three attributes shall have the same unit. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in 7.6 of ISO/IEC 15938-5:2003.
xDistancelevels	Describes the number of distance levels that the device can provide in between maximum and minimum distance on x-axis. EXAMPLE The value 5 means the device can provide 5 steps from minimum to maximum distance in x-axis.
yDistancelevels	Describes the number of distance levels that the device can provide in between maximum and minimum distance on y-axis.
zDistancelevels	Describes the number of distance levels that the device can provide in between maximum and minimum distance on z-axis.
xSpeedLevels	Describes the number of speed levels that the device can provide in between maximum and minimum speed on x-axis.

Name	*Definition*
ySpeedLevels	Describes the number of speed levels that the device can provide in between maximum and minimum speed on y-axis.
zSpeedLevels	Describes the number of speed levels that the device can provide in between maximum and minimum speed on z-axis.
xAccelLevels	Describes the number of acceleration that the device can provide in between maximum and minimum acceleration on x-axis.
yAccelLevels	Describes the number of acceleration that the device can provide in between maximum and minimum acceleration on y-axis.
zAccelLevels	Describes the number of acceleration that the device can provide in between maximum and minimum acceleration on z-axis.

Semantics of the InclineCapabilityType:

Name	*Definition*
InclineCapabilityType	Tool for describing a capability on motion chair incline effect.
maxPitchAngle	Describes the maximum angle of x-axis rotation in degrees that the device can provide. NOTE The rotation angle is increased with counter-clock wise.
maxYawAngle	Describes the maximum angle of y-axis rotation in degrees that the device can provide. NOTE The rotation angle is increased with counter-clock wise.
maxRollAngle	Describes the maximum angle of z-axis rotation in degrees that the device can provide. NOTE The rotation angle is increased with counter-clock wise.
maxPitchSpeed	Describes the maximum speed of x-axis rotation that the device can provide in terms of degree per second.
maxYawSpeed	Describes the maximum speed of y-axis rotation that the device can provide in terms of degree per second.
maxRollSpeed	Describes the maximum speed of z-axis rotation that the device can provide in terms of degree per second.
speedUnit	Specifies the common unit of the description of maxPitchSpeed, maxYawSpeed, and maxRollSpeed attributes as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than degree per sencod is used. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in 7.6 of ISO/IEC 15938-5:2003.

Name	*Definition*
maxPitchAccel	Describes the maximum acceleration of x-axis rotation that the device can provide in terms of degree per second square.
maxYawAccel	Describes the maximum acceleration of y-axis rotation that the device can provide in terms of degree per second square.
maxRollAccel	Describes the maximum acceleration of z-axis rotation that the device can provide in terms of degree per second square.
accelUnit	Specifies the common unit of the description of maxPitchAccel, maxYawAccel, and maxRollAccel attributes as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if any unit other than degree per sencod square is used. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in 7.6 of ISO/IEC 15938-5:2003.
pitchAngleLevels	Describes the number of rotation angle levels that the device can provide in between maximum and minimum angle of x-axis rotation. EXAMPLE The value 5 means the device can provide 5 steps from minimum to maximum rotation angle on x-axis.
yawAngleLevels	Describes the number of rotation angle levels that the device can provide in between maximum and minimum angle of y-axis rotation.
rollAngleLevels	Describes the number of rotation angle levels that the device can provide in between maximum and minimum angle of z-axis rotation.
pitchSpeedLevels	Describes the number of rotation speed levels that the device can provide in between maximum and minimum speed of x-axis rotation. EXAMPLE The value 5 means the device can provide 5 steps from minimum to maximum rotation angle on x-axis.
yawSpeedLevels	Describes the number of rotation speed levels that the device can provide in between maximum and minimum speed of y-axis rotation.
rollSpeedLevels	Describes the number of rotation speed levels that the device can provide in between maximum and minimum speed of z-axis rotation.
pitchAccelLevles	Describes the number of rotation acceleration levels that the device can provide in between maximum and minimum acceleration of x-axis rotation.
yawAccelLevles	Describes the number of rotation acceleration levels that the device can provide in between maximum and minimum acceleration of y-axis rotation.
rollAccelLevles	Describes the number of rotation acceleration levels that the device can provide in between maximum and minimum acceleration of z-axis rotation.

5.15.3 Examples

This example shows the description of a MoveToward capability. This device can move maximum 20cm on x and y-axis. The maximum speed of example device on x-axis, y-axis is 10cm/sec and z-axis is 0. Also the maximum acceleration on x-axis, y-axis is 1cm/sec^2 and z-axis is 0. That is, example device can not move on z-axis. x speed level and acceleration level is '10' and '5', y speed level and acceleration level is '5' respectively.

```
<dcdv:MoveTowardCapability    maxXAccel="1"    maxXSpeed="10"    maxXDistance="20"
maxYAccel="1"    maxYSpeed="10"   maxYDistance="20"   maxZAccel="0"   maxZSpeed="0"
maxZDistance="0"    xAccelLevels="5"    xDistanceLevels="20"    xSpeedLevels="10"
yAccelLevels="5"    yDistanceLevels="20"    ySpeedLevels="20"    zAccelLevels="0"
zDistanceLevels="0" zSpeedLevels="0"/>
```

This example shows the description of an Incline capability. This device can rotate 180 and 90 degree on x and y-axis. The maximum speed of example device on x-axis, y-axis is 10degree/sec and z-axis is 0. Also the maximum acceleration on x-axis, y-axis is 2degree/sec^2 and z-axis is 0. That is, example device can not move on z-axis. x speed level and acceleration level is '1', y speed level and acceleration level is '1' respectively.

```
<dcdv:InclineCapability maxPitchAccel="2" maxPitchAngle="180" maxPitchSpeed="10"
maxYawAccel="2"      maxYawAngle="90"      maxYawSpeed="10"      maxRollAccel="0"
maxRollAngle="0"   maxRollSpeed="0"   pitchAccelLevels="1"   pitchAngleLevels="1"
pitchSpeedLevels="1"   yawAccelLevels="1"   yawAngleLevels="1"   yawSpeedLevels="1"
rollAccelLevels="0" rollAngleLevels="0" rollSpeedLevels="0"/>
```

6 Sensor capability description vocabulary

6.1 Introduction

This Clause describes syntax and semantics of the sensor capability description vocabulary to implement description of capability of individual sensor devices.

6.2 Schema wrapper conventions

The Syntax defined in this Clause assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-
CT-NS" xmlns:cidl="urn:mpeg:mpeg-v:2010:01-CIDL-NS" xmlns:scdv="urn:mpeg:mpeg-
v:2010:01-SCDV-NS" targetNamespace="urn:mpeg:mpeg-v:2010:01-SCDV-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-x" id="MPEG-V-SCDV.xsd">
   <import namespace="urn:mpeg:mpeg7:schema:2004"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
7_schema_files/mpeg7-v2.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2010:01-CIDL-NS"
schemaLocation="CIDL.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2010:01-CT-NS"
schemaLocation="CommonXSD.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

6.3 Light sensor capability type

6.3.1 Syntax

```
<!-- ################################################ -->
<!-- Light Sensor capability type                     -->
<!-- ################################################ -->
<complexType name="LightSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Color" type="mpegvct:colorType" minOccurs="0"
               maxOccurs="unbounded"/>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.3.2 Semantics

Semantics of the `LightSensorCapabilityType` type:

Name	*Definition*
`LightSensorCapabilityType`	Tool for describing a light sensor capability.
`maxValue`	Describes the maximum value that the light sensor can perceive in terms of LUX.
`minValue`	Describes the minimum value that the light sensor can perceive in terms of LUX.
`Color`	Describes the list of colors which the lighting device can provide either as a reference to a classification scheme term or as RGB value. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. A CS that may be used for this purpose is the `ColorCS` defined in A.2.2 of ISO/IEC 23005-6. EXAMPLE `urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue` would describe the color Alice blue.
`Location`	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

6.3.3 Examples

This example shows the description of a light sensing capability with the following semantics. The sensor has an ID of "LS001" and the maximum value shall be 400 (LUX) and the minimum value shall be 0 (LUX) with the resolution of 50 levels. The accuracy of the sensor is 10.0 (LUX), The offset of sensor is 1.5 (LUX). The sensor shall detect the color #FF000. The sensed information is received at the location of (1.00, 1.00, -1.00).

```
<cidl:SensorDeviceCapability xsi:type="scdv:LightSensorCapabilityType" id="LS001"
maxValue="400" minValue="0" numOfLevels="50" offset="1.5">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="10.0"/>
      <scdv:Color>#FF000</scdv:Color>
      <scdv:Location>
         <mpegvct:X>1.0</mpegvct:X>
         <mpegvct:Y>1.0</mpegvct:Y>
         <mpegvct:Z>-1.0</mpegvct:Z>
      </scdv:Location>
</cidl:SensorDeviceCapability>
```

6.4 Ambient noise sensor capability type

6.4.1 Syntax

```
<!-- ################################################ -->
<!-- Ambient noise Sensor capability type                    -->
<!-- ################################################ -->
<complexType name="AmbientNoiseSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.4.2 Semantics

Semantics of the `AmbientNoiseSensorCapabilityType` type:

Name	*Definition*
`AmbientNoiseSensorCapabilityType`	Tool for describing an ambient noise sensor capability.
`maxValue`	Describes the maximum value that the ambient noise sensor can perceive in terms of decibel (dB).
`minValue`	Describes the minimum value that the ambient noise sensor can perceive in terms of decibel (dB).
`Location`	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

6.4.3 Examples

This example shows the description of an ambient noise sensing capability with the following semantics. The sensor has an ID of "ANS001" and the maximum value shall be 200 (dB) and the minimum value shall be -100 (dB) with the resolution of 600 levels. The accuracy of the sensor is 0.5 (dB), the offset of sensor is 0.1 (dB). The sensed information is received at the location of (1.00, 1.00, -1.00).

```
<cidl:SensorDeviceCapability     xsi:type="scdv:AmbientNoiseSensorCapabilityType"
id="ANS001" maxValue="200" minValue="-100" numOfLevels="600" offset="0.1">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.5"/>
   <scdv:Location>
      <mpegvct:X>1.0</mpegvct:X>
      <mpegvct:Y>1.0</mpegvct:Y>
      <mpegvct:Z>-1.0</mpegvct:Z>
   </scdv:Location>
</cidl:SensorDeviceCapability>
```

6.5 Temperature sensor capability type

6.5.1 Syntax

```
<!-- ################################################ -->
<!-- Temperature Sensor capability type               -->
<!-- ################################################ -->
<complexType name="TemperatureSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.5.2 Semantics

Semantics of the `TemperatureSensorCapabilityType` type:

Name	*Definition*
`TemperatureSensorCapabilityType`	Tool for describing a temperature sensor capability.
`maxValue`	Describes the maximum value that the temperature sensor can perceive in the unit of Celsius (or Fahrenheit).
`minValue`	Describes the minimum value that the temperature sensor can perceive in the unit of Celsius (or Fahrenheit).
`Location`	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

6.5.3 Examples

This example shows the description of a temperature sensing capability with the following semantics. The sensor has an ID of “TS001” and the maximum value shall be 120 (°C) and the minimum value shall be -20 (°C) with the resolution of 1400 levels. The accuracy of the sensor is 0.1 (°C). The offset of sensor is 1.0 (°C). The sensed information is received at the location of (1.00, 1.00, -1.00).

```
<cidl:SensorDeviceCapability      xsi:type="scdv:TemperatureSensorCapabilityType"
id="TS001"    maxValue="120"    minValue="-20"    numOfLevels="1400"    offset="1.0"
unit="celsius">
    <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
    <scdv:Location>
        <mpegvct:X>1.0</mpegvct:X>
        <mpegvct:Y>1.0</mpegvct:Y>
        <mpegvct:Z>-1.0</mpegvct:Z>
    </scdv:Location>
</cidl:SensorDeviceCapability>
```

6.6 Humidity sensor capability type

6.6.1 Syntax

```
<!-- ################################################ -->
<!-- Humidity Sensor capability type                  -->
<!-- ################################################ -->
<complexType name="HumiditySensorCapabilityType">
    <complexContent>
        <extension base="cidl:SensorCapabilityBaseType">
            <sequence>
                <element name="Location" type="mpegvct:Float3DVectorType"
                    minOccurs="0"/>
            </sequence>
        </extension>
    </complexContent>
</complexType>
```

6.6.2 Semantics

Semantics of the `HumiditySensorCapabilityType` type:

Name	*Definition*
`HumiditySensorCapabilityType`	Tool for describing a humidity sensor capability.
`maxValue`	Describes the maximum value that the humidity sensor can perceive in the unit of percentage.
`minValue`	Describes the minimum value that the humidity sensor can perceive in the unit of percentage.
`Location`	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

6.6.3 Examples

This example shows the description of a humidity sensing capability with the following semantics. The sensor has an ID of "HS001" and the maximum value shall be 100 (%) and the minimum value shall be 0 (%) with the resolution of 1000 levels. The accuracy of the sensor is 0.1 (%). The offset of sensor is 1.0 (%). The sensed information is received at the location of (1.00, 1.00, -1.00).

```
<cidl:SensorDeviceCapability          xsi:type="scdv:HumiditySensorCapabilityType"
id="HS001" maxValue="100" minValue="0" numOfLevels="1000" offset="1.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
   <scdv:Location>
      <mpegvct:X>1.0</mpegvct:X>
      <mpegvct:Y>1.0</mpegvct:Y>
      <mpegvct:Z>-1.0</mpegvct:Z>
   </scdv:Location>
</cidl:SensorDeviceCapability>
```

6.7 Distance sensor capability type

6.7.1 Syntax

```
<!-- ################################################ -->
<!-- Distance Sensor capability type                    -->
<!-- ################################################ -->
<complexType name="DistanceSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.7.2 Semantics

Semantics of the `DistanceSensorCapabilityType` type:

Name	*Definition*
`DistanceSensorCapabilityType`	Tool for describing a distance sensor capability.
`maxValue`	Describes the maximum value that the distance sensor can perceive in the unit of meter.
`minValue`	Describes the minimum value that the distance sensor can perceive in the unit of meter.
`Location`	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis in the unit of meter (m).

6.7.3 Examples

This example shows the description of a distance sensing capability with the following semantics. The sensor has an ID of “DS001” and the maximum value shall be 10 (m) and the minimum value shall be 0 (m) with the resolution of 1000 levels. The accuracy of the sensor is 0.01 (m). The offset of sensor is 0.1 (m). The sensed information is received at the location of (1.00, 1.00, -1.00).

```
<cidl:SensorDeviceCapability          xsi:type="scdv:DistanceSensorCapabilityType"
id="DS001" maxValue="10" minValue="0" numOfLevels="1000" offset="0.1">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
   <scdv:Location>
      <mpegvct:X>1.0</mpegvct:X>
      <mpegvct:Y>1.0</mpegvct:Y>
      <mpegvct:Z>-1.0</mpegvct:Z>
   </scdv:Location>
</cidl:SensorDeviceCapability>
```

6.8 Atmospheric Pressure sensor capability type

6.8.1 Syntax

```
<!-- ################################################ -->
<!-- Atmospheric Pressure Sensor capability type      -->
<!-- ################################################ -->
<complexType name="AtmosphericPressureSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.8.2 Semantics

Semantics of the `AtmosphericPressureSensorCapabilityType` type:

Name	*Definition*
`AtmosphericPressure SensorCapabilityType`	Tool for describing an atmospheric pressure sensor capability.
`maxValue`	Describes the maximum value that the atmospheric pressure sensor can perceive in the unit of hectopascal (hPa).
`minValue`	Describes the minimum value that the atmospheric pressure sensor can perceive in the unit of hectopascal (hPa).
`Location`	Describes the location of the device from the global coordinate system according to the x-, y-, and z-axis.

6.8.3 Examples

This example shows the description of an atmospheric pressure sensing capability with the following semantics. The sensor has an ID of “APS001” and the maximum value shall be 1075 (hPa) and the minimum value shall be 910 (hPa) with the resolution of 1650 levels. The accuracy of the sensor is 0.1 (hPa). The offset of sensor is 1.0 (hPa). The sensed information is received at the location of (1.00, 1.00, -1.00).

```
<cidl:SensorDeviceCapability
xsi:type="scdv:AtmosphericPressureSensorCapabilityType"                id="APS001"
maxValue="1075.0" minValue="910.0" numOfLevels="1650" offset="1.0">
    <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
    <scdv:Location>
        <mpegvct:X>1.0</mpegvct:X>
        <mpegvct:Y>1.0</mpegvct:Y>
        <mpegvct:Z>-1.0</mpegvct:Z>
    </scdv:Location>
</cidl:SensorDeviceCapability>
```

6.9 Position sensor capability type

6.9.1 Syntax

```
<!-- ################################################ -->
<!-- Position Sensor capability type                                -->
<!-- ################################################ -->
<complexType name="PositionSensorCapabilityType">
    <complexContent>
        <extension base="cidl:SensorCapabilityBaseType">
            <sequence>
                <element name="Range" type="scdv:RangeType"/>
            </sequence>
        </extension>
    </complexContent>
</complexType>

<complexType name="RangeType">
    <sequence>
        <element name="XminValue" type="float"/>
        <element name="XmaxValue" type="float"/>
        <element name="YminValue" type="float"/>
        <element name="YmaxValue" type="float"/>
        <element name="ZminValue" type="float"/>
        <element name="ZmaxValue" type="float"/>
    </sequence>
</complexType>
```

6.9.2 Semantics

Semantics of the `PositionSensorCapabilityType` type:

Name	*Definition*
`PositionSensorCapabilityType`	Tool for describing a position sensor capability.
`unit`	Describes the unit of the sensor's measuring value. Specifies the unit of the sensor's measuring value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if a unit other than the default unit specified in the semantics of the `XmaxValue/YmaxValue/ZmaxValue` and `XminValue/YminValue/ZminValue` is used. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`Range`	Describes the range that the position sensor can perceive in terms of RangeType in its global coordinate system. NOTE The `minValue` and the `maxValue` in the `SensorCapabilityBaseType` are not used for this sensor.
`RangeType`	Defines the range in a local coordinate system relative to the position of the sensor in idle state according to the x-, y-, and z-axis.
`XminValue`	Describes the minimum value that the position sensor can perceive along the x-axis in the unit of meter.
`XmaxValue`	Describes the maximum value that the position sensor can perceive along the x-axis in the unit of meter.
`YminValue`	Describes the minimum value that the position sensor can perceive along the y-axis in the unit of meter.
`YmaxValue`	Describes the maximum value that the position sensor can perceive along the y-axis in the unit of meter.
`ZminValue`	Describes the minimum value that the position sensor can perceive along the z-axis in the unit of meter.
`ZmaxValue`	Describes the maximum value that the position sensor can perceive along the z-axis in the unit of meter.

6.9.3 Examples

This example shows the description of a position sensing capability with the following semantics. The sensor has an ID of "PS001" and the maximum value shall be `XmaxValue`="10.0", `YmaxValue`="10.0" and `ZmaxValue`="10.0" (m), and the minimum value shall be `XminValue`="-10.0", `YminValue`="-10.0" and `ZminValue`="-10.0" (m) with the resolution of 2000 levels. The accuracy of the sensor is 0.01 (m). The SNR of the sensor is 0.1 (dB). The offset of sensor is 1.0 (m).

```
<cidl:SensorDeviceCapability          xsi:type="scdv:PositionSensorCapabilityType"
id="PS001" numOfLevels="2000" SNR="0.1" offset="1.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
   <scdv:Range xsi:type="scdv:RangeType">
      <scdv:XminValue>-10.0</scdv:XminValue>
      <scdv:XmaxValue>10.0</scdv:XmaxValue>
      <scdv:YminValue>-10.0</scdv:YminValue>
      <scdv:YmaxValue>10.0</scdv:YmaxValue>
      <scdv:ZminValue>-10.0</scdv:ZminValue>
      <scdv:ZmaxValue>10.0</scdv:ZmaxValue>
   </scdv:Range>
</cidl:SensorDeviceCapability>
```

6.10 Velocity sensor capability type

6.10.1 Syntax

```
<!-- ################################################ -->
<!-- Velocity Sensor capability type                  -->
<!-- ################################################ -->
<complexType name="VelocitySensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.10.2 Semantics

Semantics of the `VelocitySensorCapabilityType` type:

Name	*Definition*
`VelocitySensorCapabilityType`	Tool for describing a velocity sensor capability.
`maxValue`	Describes the maximum value that the velocity sensor can perceive in terms of meter/second for the given axis.
`minValue`	Describes the minimum value that the velocity sensor can perceive in terms of meter/second for the given axis.

6.10.3 Examples

This example shows the description of a velocity sensing capability with the following semantics. The sensor has an ID of “VS001” and the maximum value shall be 50 (m/s) and the minimum value shall be 0.1 (m/s) with the resolution of 5000 levels. The accuracy of the sensor is 0.01 (m/s). The offset of sensor is 0.5 (m/s).

```
<cidl:SensorDeviceCapability          xsi:type="scdv:VelocitySensorCapabilityType"
id="VS001" maxValue="50.0" minValue="0.1" numOfLevels="5000" offset="0.5">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
</cidl:SensorDeviceCapability>
```

6.11 Acceleration sensor capability type

6.11.1 Syntax

```
<!-- ################################################ -->
<!-- ################################################ -->
<!-- Acceleration Sensor capability type              -->
<!-- ################################################ -->
<complexType name="AccelerationSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.11.2 Semantics

Semantics of the `AccelerationSensorCapabilityType` type:

Name	*Definition*
`AccelerationSensor CapabilityType`	Tool for describing an acceleration sensor capability.
`maxValue`	Describes the maximum value that the acceleration sensor can perceive in terms of meter/second^2 for the given axis.
`minValue`	Describes the minimum value that the acceleration sensor can perceive in terms of meter/second^2 for the given axis.

6.11.3 Examples

This example shows the description of an acceleration sensing capability with the following semantics. The sensor has an ID of “AS001” and the maximum value shall be 9.8 (m/s^2) and the minimum value shall be -9.8 (m/s^2) with the resolution of 1000 levels. The accuracy of the sensor is 0.01 (m/s^2). The offset of sensor is 0.5 (m/s^2).

```
<cidl:SensorDeviceCapability     xsi:type="scdv:AccelerationSensorCapabilityType"
id="AS001" maxValue="9.8" minValue="-9.8" numOfLevels="1000" offset="0.5">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
</cidl:SensorDeviceCapability>
```

6.12 Orientation sensor capability type

6.12.1 Syntax

```
<!-- ################################################ -->
<!-- Orientation Sensor capability type               -->
<!-- ################################################ -->
<complexType name="OrientationSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="OrientationRange" type="scdv:OrientationRangeType"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>

<complexType name="OrientationRangeType">
   <sequence>
      <element name="YawMin" type="float"/>
      <element name="YawMax" type="float"/>
      <element name="PitchMin" type="float"/>
      <element name="PitchMax" type="float"/>
      <element name="RollMin" type="float"/>
      <element name="RollMax" type="float"/>
   </sequence>
</complexType>
```

6.12.2 Semantics

Semantics of the `OrientationSensorCapabilityType` type:

Name	*Definition*
`OrientationSensorCapabilityType`	Tool for describing an orientation sensor capability.
`OrientationRange`	Describes the range that the orientation sensor can perceive in terms of OrientationRangeType.
`OrientationRangeType`	Defines the range from the local coordinate system according to the Yaw, Pitch and Roll.
`YawMin`	Describes the minimum value that the orientation sensor can perceive for Yaw in the unit of degree.
`YawMax`	Describes the maximum value that the orientation sensor can perceive for Yaw in the unit of degree.
`PitchMin`	Describes the minimum value that the orientation sensor can perceive for Pitch in the unit of degree.
`PitchMax`	Describes the maximum value that the orientation sensor can perceive for Pitch in the unit of degree.

Name	*Definition*
RollMin	Describes the minimum value that the orientation sensor can perceive for Roll in the unit of degree.
RollMax	Describes the maximum value that the orientation sensor can perceive for Roll in the unit of degree.

NOTE 1 The local coordinate system is defined as right-handed coordinate system.

NOTE 2 Since the sensor has multidimensional information, the OrientationRangeType defined in this Subclause shall be used to describe the range of the possible value instead of the minValue and the maxValue in the SensorCapabilityBaseType for this sensor.

6.12.3 Examples

This example shows the description of an orientation sensing capability with the following semantics. The sensor has an ID of "OS001" and the maximum value shall be YawMax ="10.0", PitchMax ="10.0" and RollMax ="10.0" (rad), and the minimum value shall be YawMin ="-10.0", PitchMin ="-10.0" and RollMin ="-10.0" (degrees) with the resolution of 1000 levels. The accuracy of the sensor is 0.01 (rad). The SNR of the sensor is 0.1 (dB). The offset of sensor is 1.0 (rad).

```
<cidl:SensorDeviceCapability      xsi:type="scdv:OrientationSensorCapabilityType"
id="OS001" unit="radian" numOfLevels="1000" SNR="0.1" offset="1.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
   <scdv:OrientationRange xsi:type="scdv:OrientationRangeType">
      <scdv:YawMin>-10.0</scdv:YawMin>
      <scdv:YawMax>10.0</scdv:YawMax>
      <scdv:PitchMin>-10.0</scdv:PitchMin>
      <scdv:PitchMax>10.0</scdv:PitchMax>
      <scdv:RollMin>-10.0</scdv:RollMin>
      <scdv:RollMax>10.0</scdv:RollMax>
   </scdv:OrientationRange>
</cidl:SensorDeviceCapability>
```

6.13 Angular velocity sensor capability type

6.13.1 Syntax

```
<!-- ################################################ -->
<!-- Angular Velocity Sensor capability type          -->
<!-- ################################################ -->
<complexType name="AngularVelocitySensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.13.2 Semantics

Semantics of the `AngularVelocitySensorCapabilityType` type:

Name	*Definition*
`AngularVelocity SensorCapabilityType`	Tool for describing an angular velocity sensor capability.
`maxValue`	Describes the maximum value that the angular velocity sensor can perceive in terms of radian/second for each axis.
`minValue`	Describes the minimum value that the angular velocity sensor can perceive in terms of radian/second for each axis.

6.13.3 Examples

This example shows the description of an angular velocity sensing capability with the following semantics. The sensor has an ID of "AVS001" and the maximum value shall be 5.0 (rad/s) and the minimum value shall be -5.0 (rad/s) with the resolution of 1000 levels. The accuracy of the sensor is 0.01 (rad/s). The offset of sensor is 0.01 (rad/s).

```
<cidl:SensorDeviceCapability  xsi:type="scdv:AngularVelocitySensorCapabilityType"
id="AVS001"  unit="radpersec"  maxValue="5.0"  minValue="-5.0"  numOfLevels="1000"
offset="0.01">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
</cidl:SensorDeviceCapability>
```

6.14 Angular acceleration sensor capability type

6.14.1 Syntax

```
<!-- ################################################ -->
<!-- Angular Acceleration Sensor capability type                    -->
<!-- ################################################ -->
<complexType name="AngularAccelerationSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.14.2 Semantics

Semantics of the `AngularAccelerationSensorCapabilityType` type:

Name	*Definition*
`AngularAcceleration SensorCapabilityType`	Tool for describing an angular acceleration sensor capability.

Name	*Definition*
maxValue	Describes the maximum value that the angular acceleration sensor can perceive in terms of radian/second^2 for each axis.
minValue	Describes the minimum value that the angular acceleration sensor can perceive in terms of radian/second^2 for each axis.

6.14.3 Examples

This example shows the description of an angular acceleration sensing capability with the following semantics. The sensor has an ID of "AAS001" and the maximum value shall be 200.0 (rad/s^2) and the minimum value shall be -200.0 (rad/s^2) with the resolution of 1000 levels. The accuracy of the sensor is 0.1 (rad/s^2). The offset of sensor is 0.5 (rad/s^2).

```
<cidl:SensorDeviceCapability
xsi:type="scdv:AngularAccelerationSensorCapabilityType"          id="AAS001"
unit="radpersecsquared"   maxValue="200.0"   minValue="-200.0"  numOfLevels="1000"
offset="0.5">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
</cidl:SensorDeviceCapability>
```

6.15 Force sensor capability type

6.15.1 Syntax

```
<!-- ################################################ -->
<!-- Force Sensor capability type                     -->
<!-- ################################################ -->
<complexType name="ForceSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.15.2 Semantics

Semantics of the ForceSensorCapabilityType:

Name	*Definition*
ForceSensorCapabilityType	Tool for describing a force sensor capability.
maxValue	Describes the maximum value that the force sensor can perceive in terms of N (Newton) for each axis.
minValue	Describes the minimum value that the force sensor can perceive in terms of N (Newton) for each axis.

6.15.3 Examples

This example shows the description of a force sensing capability with the following semantics. The sensor has an ID of “FS001” and the maximum value shall be 5.0 (N) and the minimum value shall be 0.0 (N) with the resolution of 500 levels. The accuracy of the sensor is 0.01 (N). The offset of sensor is 0.05 (N).

```
<cidl:SensorDeviceCapability xsi:type="scdv:ForceSensorCapabilityType" id="FS001"
maxValue="5.0" minValue="0.0" numOfLevels="500" offset="0.05">
    <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
</cidl:SensorDeviceCapability>
```

6.16 Torque sensor capability type

6.16.1 Syntax

```
<!-- ################################################ -->
<!-- Torque Sensor capability type                    -->
<!-- ################################################ -->
<complexType name="TorqueSensorCapabilityType">
    <complexContent>
        <extension base="cidl:SensorCapabilityBaseType"/>
    </complexContent>
</complexType>
```

6.16.2 Semantics

Semantics of the `TorqueSensorCapabilityType`:

Name	*Definition*
`TorqueSensorCapabilityType`	Tool for describing a torque sensor capability.
`maxValue`	Describes the maximum value that the torque sensor can perceive in terms of N-mm (Newton millimeter) for each axis.
`minValue`	Describes the minimum value that the torque sensor can perceive in terms of N-mm (Newton millimeter) for each axis.

6.16.3 Examples

This example shows the description of a torque sensing capability with the following semantics. The sensor has an ID of “TS001” and the maximum value shall be 200.0 (Nmm) and the minimum value shall be 0.0 (Nmm) with the resolution of 20000 levels. The accuracy of the sensor is 0.01 (Nmm). The offset of sensor is 0.05 (Nmm).

```
<cidl:SensorDeviceCapability           xsi:type="scdv:TorqueSensorCapabilityType"
id="ToS001" maxValue="200.0" minValue="0.0" numOfLevels="20000" offset="0.05">
    <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
</cidl:SensorDeviceCapability>
```

6.17 Pressure sensor capability type

6.17.1 Syntax

```
<!-- ################################################ -->
<!-- Pressure Sensor capability type                  -->
<!-- ################################################ -->
<complexType name="PressureSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.17.2 Semantics

Semantics of the `PressureSensorCapabilityType`:

Name	*Definition*
`PressureSensor CapabilityType`	Tool for describing a pressure sensor capability.
`maxValue`	Describes the maximum value that the pressure sensor can perceive in terms of N/mm^2 (Newton/millimeter square) for each axis.
`minValue`	Describes the minimum value that the pressure sensor can perceive in terms of N/mm^2 (Newton/millimeter square) for each axis.

6.17.3 Examples

This example shows the description of a pressure sensing capability with the following semantics. The sensor has an ID of “PRS001” and the maximum value shall be 2.5 (N/mm^2) and the minimum value shall be 0.0 (N/mm^2) with the resolution of 2500 levels. The accuracy of the sensor is 0.001 (N/mm^2). The offset of sensor is 0.05 (N/mm^2).

```
<cidl:SensorDeviceCapability          xsi:type="scdv:PressureSensorCapabilityType"
id="PRS001" maxValue="2.5" minValue="0.0" numOfLevels="2500" offset="0.05">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.001"/>
</cidl:SensorDeviceCapability>
```

6.18 Motion sensor capability type

6.18.1 Syntax

```
<!-- ################################################ -->
<!-- Motion Sensor capability type                    -->
<!-- ################################################ -->
<complexType name="MotionSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
```

```
            <sequence>
                <element name="PositionCapability"
                    type="scdv:PositionSensorCapabilityType" minOccurs="0"/>
                <element name="OrientationCapability"
                    type="scdv:OrientationSensorCapabilityType" minOccurs="0"/>
                <element name="VelocityCapability"
                    type="scdv:VelocitySensorCapabilityType" minOccurs="0"/>
                <element name="AngularVelocityCapability"
                    type="scdv:AngularVelocitySensorCapabilityType" minOccurs="0"/>
                <element name="AccelerationCapability"
                    type="scdv:AccelerationSensorCapabilityType" minOccurs="0"/>
                <element name="AngularAccelerationCapability"
                    type="scdv:AngularAccelerationSensorCapabilityType"
                    minOccurs="0"/>
            </sequence>
        </extension>
    </complexContent>
</complexType>
```

6.18.2 Semantics

Semantics of the `AngularAccelerationSensorCapabilityType` type:

Name	*Definition*
`MotionSensorCapabilityType`	Tool for describing a motion sensor capability.
`PositionCapability`	Describes the capability with respect to the position as defined in `PositionSensorCapabilityType`.
`OrientationCapability`	Describes the capability with respect to the orientation as defined in `OrientationSensorCapabilityType`.
`VelocityCapability`	Describes the capability with respect to the velocity as defined in `VelocitySensorCapabilityType`.
`AngularVelocityCapability`	Describes the capability with respect to the angular as defined in `AngularVelocitySensorCapabilityType`.
`AccelerationCapability`	Describes the capability with respect to the acceleration as defined in `AccelerationSensorCapabilityType`.
`AngularAccelerationCapability`	Describes the capability with respect to the angular acceleration as defined in `AngularAccelerationSensorCapabilityType`.

6.18.3 Examples

This example shows the description of a motion sensing capability with the following semantics. The motion sensor is with id of “MS001”. It is composed of position sensor with id “MSPC001”, orientation sensor with id “MSOC001”, velocity sensor with id “MSVC0001”, angular velocity sensor with id “MSAVC0001”, acceleration sensor with id “MSAC0001”, and angular acceleration sensor with id “MSAAC0001”.

```
<cidl:SensorDeviceCapability           xsi:type="scdv:MotionSensorCapabilityType"
id="MS001">
    <scdv:PositionCapability id="MSPC001" SNR="0.1" numOfLevels="10000"
    xsi:type="scdv:PositionSensorCapabilityType">
        <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
        <scdv:Range xsi:type="scdv:RangeType">
            <scdv:XminValue>0.0</scdv:XminValue>
            <scdv:XmaxValue>3.0</scdv:XmaxValue>
            <scdv:YminValue>0.0</scdv:YminValue>
            <scdv:YmaxValue>3.0</scdv:YmaxValue>
            <scdv:ZminValue>0.0</scdv:ZminValue>
            <scdv:ZmaxValue>3.0</scdv:ZmaxValue>
        </scdv:Range>
    </scdv:PositionCapability>
    <scdv:OrientationCapability id="MSOC001" SNR="0.1" unit="radian"
    numOfLevels="10000" xsi:type="scdv:OrientationSensorCapabilityType">
        <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
        <scdv:OrientationRange>
            <scdv:YawMin>-3.14</scdv:YawMin>
            <scdv:YawMax>3.14</scdv:YawMax>
            <scdv:PitchMin>-3.14</scdv:PitchMin>
            <scdv:PitchMax>3.14</scdv:PitchMax>
            <scdv:RollMin>-1.57</scdv:RollMin>
            <scdv:RollMax>1.57</scdv:RollMax>
        </scdv:OrientationRange>
    </scdv:OrientationCapability>
    <scdv:VelocityCapability id="MSVC0001"
    xsi:type="scdv:VelocitySensorCapabilityType" maxValue="50.0" minValue="0.1"
    numOfLevels="1000">
        <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
    </scdv:VelocityCapability>
    <scdv:AngularVelocityCapability id="MSAVC0001"
    xsi:type="scdv:AngularVelocitySensorCapabilityType" maxValue="5.0"
    minValue="-5.0">
        <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.1"/>
    </scdv:AngularVelocityCapability>
    <scdv:AccelerationCapability id="MSAC0001" maxValue="9.8" minValue="-9.8"/>
    <scdv:AngularAccelerationCapability id="MSAAC0001" maxValue="200.0"
    minValue="-200.0"/>
</cidl:SensorDeviceCapability>
```


6.19 Intelligent camera capability type

6.19.1 Syntax

```
<!-- ################################################ -->
<!-- Intelligent Camera  CapabilityType               -->
<!-- ################################################ -->
<complexType name="IntelligentCameraCapabilityType">
    <complexContent>
        <extension base="cidl:SensorCapabilityBaseType">
            <sequence>
                <element name="MaxBodyFeaturePoint" type="nonNegativeInteger"
                    minOccurs="0"/>
                <element name="MaxFaceFeaturePoint" type="nonNegativeInteger"
                    minOccurs="0"/>
```

```
            <element name="TrackedFeature" type="scdv:FeatureType"
               minOccurs="0"/>
            <element name="TrackedFacialFeaturePoints"
               type="scdv:FacialFeatureMask" minOccurs="0"/>
            <element name="TrackedBodyFeaturePoints"
               type="scdv:BodyFeatureMask" minOccurs="0"/>
         </sequence>
         <attribute name="featureTrackingStatus" type="boolean" use="optional"
            default="false"/>
         <attribute name="facialExpressionTrackingStatus" type="boolean"
            use="optional" default="false"/>
         <attribute name="gestureTrackingStatus"  type="boolean"  use="optional"
            default="false"/>
      </extension>
   </complexContent>
</complexType>

<simpleType name="FeatureType">
   <restriction base="string">
      <enumeration value="face"/>
      <enumeration value="body"/>
      <enumeration value="both"/>
   </restriction>
</simpleType>

<complexType name="FacialFeatureMask">
   <sequence>
      <element name="FaceFeaturePoint" type="boolean" minOccurs="60"
         maxOccurs="200"/>
   </sequence>
</complexType>

<complexType name="BodyFeatureMask">
   <sequence>
      <element name="BodyFeaturePoint" type="boolean" minOccurs="60"
         maxOccurs="200"/>
   </sequence>
</complexType>
```


6.19.2 Semantics

Semantics of the `IntelligentCameraCapabilityType` type:

Name	*Definition*
`IntelligentCameraCapabilityType`	Tool for describing an intelligent camera capability.
`MaxBodyFeaturePoint`	Describes the maximum number of body feature points that the intelligent camera can track.
`MaxFaceFeaturePoint`	Describes the maximum number of facial feature points that the intelligent camera can track.
`TrackedFeature`	Describes what kind of feature points can be tracked as given in `FeatureType`, e.g., body, face or both.

Name	*Definition*
TrackedFacialFeature Points	Describes whether each of the facial feature points orderly listed in 5.2.7.4 of ISO/IEC 23005-4 is active or not, based on FacialFeatureMask.
TrackedBodyFeature Points	Describes whether each of the body feature points orderly listed in 5.2.7.6 of ISO/IEC 23005-4 is active or not, based on BodyFeatureMask.
featureTracking Status	Describes whether the feature tracking is capable or not.
facialExpression TrackingStatus	Describes whether the intelligent camera can extract the facial animation or not.
gestureTracking Status	Describes whether the intelligent camera can extract the body animation or not.
FeatureType	Describes the types of feature to be tracked. (face, body, or both).
FacialFeatureMask	Provides a Boolean map of facial feature points in the order listed in 5.2.7.4 of ISO/IEC 23005-4 to identify active feature points.
BodyFeatureMask	Provides a Boolean map of body feature points in the order listed in 5.2.7.6 of ISO/IEC 23005-4 to identify active feature points.

6.19.3 Examples

This example shows the description of an intelligent camera sensing capability.

```
<cidl:SensorDeviceCapability      xsi:type="scdv:IntelligentCameraCapabilityType"
id="IC001" featureTrackingStatus="true" gestureTrackingStatus="true" >
    <scdv:MaxBodyFeaturePoint>69</scdv:MaxBodyFeaturePoint>
    <scdv:MaxFaceFeaturePoint>60</scdv:MaxFaceFeaturePoint>
    <scdv:TrackedFeature>both</scdv:TrackedFeature>
    <scdv:TrackedFacialFeaturePoints>
        <scdv:FaceFeaturePoint>true</scdv:FaceFeaturePoint>
        <scdv:FaceFeaturePoint>true</scdv:FaceFeaturePoint>
        <scdv:FaceFeaturePoint>true</scdv:FaceFeaturePoint>
        ...
        <scdv:FaceFeaturePoint>true</scdv:FaceFeaturePoint>
        <scdv:FaceFeaturePoint>true</scdv:FaceFeaturePoint>
        <scdv:FaceFeaturePoint>true</scdv:FaceFeaturePoint>
    </scdv:TrackedFacialFeaturePoints>
    <scdv:TrackedBodyFeaturePoints>
        <scdv:BodyFeaturePoint>true</scdv:BodyFeaturePoint>
        <scdv:BodyFeaturePoint>true</scdv:BodyFeaturePoint>
        <scdv:BodyFeaturePoint>true</scdv:BodyFeaturePoint>
        ...
        <scdv:BodyFeaturePoint>true</scdv:BodyFeaturePoint>
        <scdv:BodyFeaturePoint>true</scdv:BodyFeaturePoint>
        <scdv:BodyFeaturePoint>true</scdv:BodyFeaturePoint>
    </scdv:TrackedBodyFeaturePoints>
</cidl:SensorDeviceCapability>
```

7 User's sensory preference vocabulary

7.1 Introduction

This Clause describes syntax and semantics of the user's sensory preference vocabulary to implement description of user's preference on individual sensory effect.

7.2 Schema wrapper conventions

The Syntax defined in this Clause assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-
CT-NS" xmlns:cidl="urn:mpeg:mpeg-v:2010:01-CIDL-NS" xmlns:sepv="urn:mpeg:mpeg-
v:2010:01-SEPV-NS" targetNamespace="urn:mpeg:mpeg-v:2010:01-SEPV-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-x" id="MPEG-V-SEPV.xsd">
    <import namespace="urn:mpeg:mpeg7:schema:2004"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
7_schema_files/mpeg7-v2.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-CIDL-NS"
schemaLocation="CIDL.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-CT-NS"
schemaLocation="CommonXSD.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

7.3 Light preference type

7.3.1 Syntax

```
<!-- ################################################ -->
<!-- Light Preference type                             -->
<!-- ################################################ -->
<complexType name="LightPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <sequence>
            <element name="UnfavorableColor" type="mpegvct:colorType"
               minOccurs="0" maxOccurs="unbounded"/>
         </sequence>
         <attribute name="maxIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.3.2 Semantics

Semantics of the `LightPrefType` type:

Name	*Definition*
`LightPrefType`	Tool for describing a user preference on light effect.
`maxIntensity`	Describes the maximum desirable intensity of the light effect in terms of illumination with respect to [10^{-5} lux, 130 klux].
`unit`	Specifies the unit of the `maxIntensity` value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if a unit other than the default unit specified in the semantics of the `maxIntensity` is used. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`UnfavorableColor`	Describes the list of user's detestable colors either as a reference to a classification scheme term or as RGB value. A CS that may be used for this purpose is the ColorCS defined in A.2.2 of ISO/IEC 23005-6. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. EXAMPLE `urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue` would describe the color Alice blue.

7.3.3 Examples

This example shows the description of a user preference on light effect with the following semantics. The light effect is desired with the maximum intensity of 300 lux. A color, which is refused by user, is "alice_blue" from the classification scheme described in A2.2 of ISO/IEC 23005-6.

```
<cidl:ControlInfo>
  <cidl:UserSensoryPreferenceList>
    <cidl:USPreference xsi:type="sepv:LightPrefType" activate="true"
    ="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:lux" maxIntensity="300">
       <sepv:UnfavorableColor>
       :mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue
       </sepv:UnfavorableColor>
    </cidl:USPreference>
  </cidl:UserSensoryPreferenceList>
</cidl:ControlInfo>
```

7.4 Flash preference type

7.4.1 Syntax

```
<!-- ################################################ -->
<!--  Flash Preference type                           -->
<!-- ################################################ -->
<complexType name="FlashPrefType">
   <complexContent>
      <extension base="sepv:LightPrefType">
         <attribute name="maxFrequency" type="positiveInteger" use="optional"/>
         <attribute name="freqUnit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.4.2 Semantics

Semantics of the `FlashPrefType` type:

Name	*Definition*
`FlashPrefType`	Tool for describing a user preference on flash effect. It is extended from the light type.
`maxFrequency`	Describes the maximum allowed number of flickering in times per second. EXAMPLE The value 10 means it will flicker 10 times for each second.
`freqUnit`	Specifies the unit of the `maxFrequency` value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if a unit other than the default unit specified in the semantics of the `maxFrequency` is used. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.

7.4.3 Examples

This example shows the description of a user preference on flash effect with the following semantics. The flash is desired with the maximum frequency of 50 times per second.

```
<cidl:ControlInfo>
  <cidl:UserSensoryPreferenceList>
     <cidl:USPreference xsi:type="sepv:FlashPrefType" activate="true"
     maxFrequency="50" ="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:Hertz"/>
  </cidl:UserSensoryPreferenceList>
</cidl:ControlInfo>
```

7.5 Heating preference type

7.5.1 Syntax

```
<!-- ################################################ -->
<!-- Heating Preference type                          -->
<!-- ################################################ -->
<complexType name="HeatingPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <attribute name="minIntensity" type="integer" use="optional"/>
         <attribute name="maxIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.5.2 Semantics

Semantics of the `HeatingPrefType` type:

Name	*Definition*
`HeatingPrefType`	Tool for describing a user preference on heating effect.
`maxIntensity`	Describes the highest desirable temperature of the heating effect with respect to the Celsius scale (or Fahrenheit).
`minIntensity`	Describes the lowest desirable temperature of the heating effect with respect to the Celsius scale (or Fahrenheit).
`unit`	Specifies the unit of the `maxIntensity` and `minIntensity` value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.

7.5.3 Examples

This example shows a description of a user preference on heating effect with the following semantics. The identifier for this preference description is “heater001”. The heating is desired with the maximum intensity of upto 50 degrees Celsius, and minimum intensity of 20 degrees Celsius. When the given command on the heating effect is not within the range of preference or capability, it should be properly scaled.

```
<cidl:ControlInfo>
  <cidl:UserSensoryPreferenceList>
    <cidl:USPreference xsi:type="sepv:HeatingPrefType" id="heater001"
    maxIntensity="50" minIntensity="20" adaptationMode="scalable"
    activate="true"/>
  </cidl:UserSensoryPreferenceList>
</cidl:ControlInfo>
```

7.6 Cooling preference type

7.6.1 Syntax

```
<!-- ################################################ -->
<!-- Cooling Preference type                          -->
<!-- ################################################ -->
<complexType name="CoolingPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <attribute name="minIntensity" type="integer" use="optional"/>
         <attribute name="maxIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.6.2 Semantics

Semantics of the `CoolingPrefType` type:

Name	*Definition*
`CoolingPrefType`	Tool for describing a user preference on cooling effect.
`maxIntensity`	Describes the lowest desirable temperature of the cooling effect with respect to the Celsius scale (or Fahrenheit).
`minIntensity`	Describes the highest desirable temperature of the cooling effect with respect to the Celsius scale (or Fahrenheit).
`unit`	Specifies the unit of the `maxIntensity` and `minIntensity` value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.

7.6.3 Examples

This example shows a description of a user preference on cooling effect with the following semantics. The identifier for this preference description is “cooling001”. The cooling is desired with the maximum intensity of upto 10 degrees Celsius, and minimum intensity of 30 degrees Celsius. When the given command on the cooling effect is not within the range of preference or capability, it should be properly scaled.

```
<cidl:ControlInfo>
  <cidl:UserSensoryPreferenceList>
    <cidl:USPreference xsi:type="sepv:CoolingPrefType" id="cooling001"
    maxIntensity="10" minIntensity="30" adaptationMode="scalable"
    activate="true"/>
  </cidl:UserSensoryPreferenceList>
</cidl:ControlInfo>
```

7.7 Wind preference type

7.7.1 Syntax

```
<!-- ################################################ -->
<!-- Wind Preference type                             -->
<!-- ################################################ -->
<complexType name="WindPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <attribute name="maxIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.7.2 Semantics

Semantics of the `WindPrefType` type:

Name	*Definition*
`WindPrefType`	Tool for describing a user preference on a wind effect.
`maxIntensity`	Describes the maximum desirable intensity of the wind effect in terms of strength with respect to the Beaufort scale.
`unit`	Specifies the unit of the `maxIntensity` value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if a unit other than the default unit specified in the semantics of the `maxIntensity` is used. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.

7.7.3 Examples

This example shows a description of a user preference on wind effect with the following semantics. The identifier for this preference description is “wind01”. The wind is desired with the maximum intensity of upto 4 Beaufort. When the given command on the wind effect is not within the range of preference or capability, it should be clipped.

```
<ControlInfo>
  <cidl:UserSensoryPreferenceList>
    <cidl:USPreference xsi:type="sepv:WindPrefType" id="wind01" maxIntensity="4"
    activate="true" adaptationMode="strict"/>
  </cidl:UserSensoryPreferenceList>
</ControlInfo>
```

7.8 Vibration preference type

7.8.1 Syntax

```
<!-- ################################################ -->
<!--  Vibration Preference type                       -->
<!-- ################################################ -->
<complexType name="VibrationPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <attribute name="maxIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.8.2 Semantics

Semantics of the `VibrationPrefType` type:

Name	*Definition*
`VibrationPrefType`	Tool for describing a user preference on vibration effect.
`maxIntensity`	Describes the maximum desirable intensity of the vibration effect in terms of strength with respect to the Richter magnitude scale.
`unit`	Specifies the unit of the `maxIntensity` value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if a unit other than the default unit specified in the semantics of the `maxIntensity` is used. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.

7.8.3 Examples

This example shows a description of a user preference on vibration effect with the following semantics. The identifier for this preference description is “vibe02”. The vibration is desired with the maximum intensity of upto 3 Richter. When the given command on the vibration effect is not within the range of preference or capability, it should be properly scaled with the maximum of 3 Richter, if the maximum intensity defined in the device capability is greater than 3.

```
<cidl:ControlInfo>
  <cidl:UserSensoryPreferenceList>
    <cidl:USPreference xsi:type="sepv:VibrationPrefType" id="vibe02"
    maxIntensity="3" activate="true" adaptationMode="scalable"/>
  </cidl:UserSensoryPreferenceList>
</cidl:ControlInfo>
```

7.9 Scent preference type

7.9.1 Syntax

```
<!-- ################################################ -->
<!--  Scent Preference type                           -->
<!-- ################################################ -->
<complexType name="ScentPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <sequence>
            <element name="UnfavorableScent" type="mpeg7:termReferenceType"
               minOccurs="0" maxOccurs="unbounded"/>
         </sequence>
         <attribute name="maxIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.9.2 Semantics

Semantics of the `ScentPrefType` type:

Name	*Definition*
`ScentPrefType`	Tool for describing a user preference on scent effect.
`UnfavorableScent`	Describes the list of user's detestable scent. A CS that may be used for this purpose is the `ScentCS` defined in A.2.4 of ISO/IEC 23005-6. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.
`maxIntensity`	Describes the maximum desirable intensity of the scent effect in terms of milliliter/hour.
`unit`	Specifies the unit of the `maxIntensity` value as a reference to a classification scheme term provided by UnitTypeCS defined in A.2.1 of ISO/IEC 23005-6, if a unit other than the default unit specified in the semantics of the `maxIntensity` is used. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003.

7.9.3 Examples

This example shows a description of a user preference on scent effect with the following semantics. The identifier for this preference description is “scent001”. The scent effect is desired with the maximum intensity of upto 4 milliliter/hour. When the given command on the scent effect is not within the range of preference or capability, it should be properly scaled with the maximum of 4 milliliter/hour, if the maximum intensity defined in the device capability is greater than 4. Also, it specifies that the scent of rose as defined in ScentCS of ISO/IEC 23005-6 is not desired.