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Fourth edition
2018-09

Information technology — Media context and control —

Part 2: Control information

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

Partie 2: Informations de contrôle

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This fourth edition cancels and replaces the third edition (ISO/IEC 23005-2:2016), which has been technically revised.

The main changes compared to the previous edition are the addition of:

— device capabilities for a 3D printer, an arryed light, and a sound displayer;

— sensor capabilities for a radar, an array camera, an E-Nose, and a microphone;

— user preferences for a 3D printing, a 3D printing colour reproduction, an arrayed light effect, and a sound display;

— sensor adaptation preferences for a radar and an arrayed camera.

A list of all parts in the ISO/IEC 23005 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO/IEC 23005 series provides an architecture and specifies information representation of data flowing in and out of the real world and virtual worlds.

The data for the real world are communicated through sensors and actuators. The data for virtual worlds consist of properties of virtual objects and multi-sensorial data embedded in audio-visual content. MPEG-V specifies data formats for sensors, actuators, virtual objects, and audio-visual content.

Data captured from the real world may need to be adapted for use in a virtual world and data from virtual worlds may also need to be adapted for use in the real world. The ISO/IEC 23005 series does not specify how the adaptation is carried out but only specifies the interfaces.

Data for sensors are sensor capabilities, sensed data, and sensor adaptation preferences.

Data for actuators are sensory device capabilities, sensory device commands, and sensory effect preferences.

Data for virtual objects are characteristics of avatars and virtual world objects.

Sensory effect may be needed to enrich audio-visual contents.

The system architecture of the ISO/IEC 23005 series is depicted in Figure 1 and the scope of this document is highlighted in yellow. The information representation that acts as control information; user's sensor and actuation preferences, actuator capabilities, and sensor capabilities – as defined in ISO/IEC 23005-1 – is specified in this document.

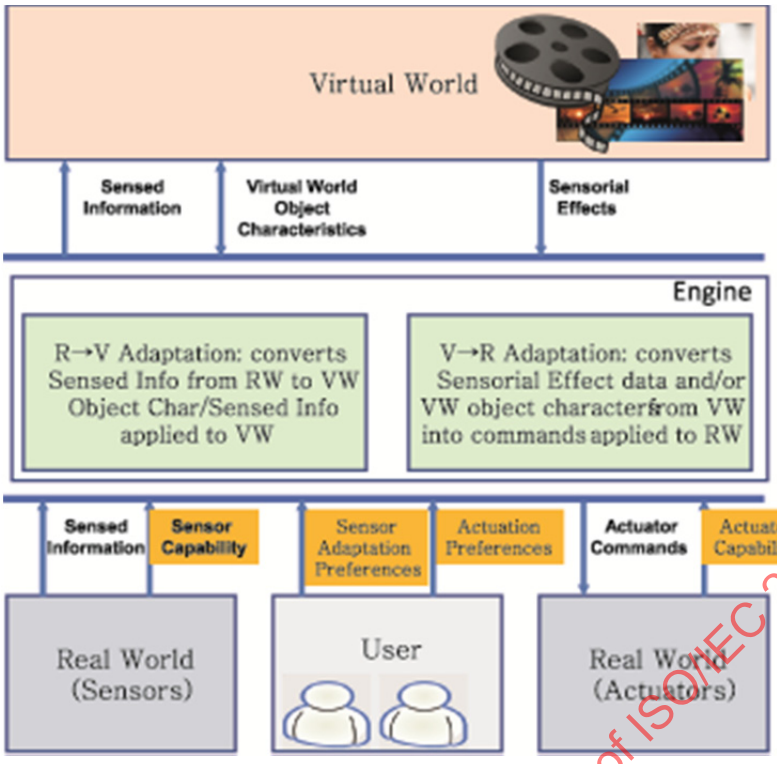


Figure 1 — Scope of the ISO/IEC 23005 series (showing this document in yellow)

This document contains the tools of the control information for the sensors and actuators. It addresses the normative aspects of the control information including device (sensors or sensory devices) capability description, user preference information (for sensor adaption or sensory effect adaptation), 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 the ISO and 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 patents right are registered with ISO and IEC. Information may be obtained from the companies listed below.

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 this list. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO (www.iso.org/patents) and IEC (http://patents.iec.ch) maintain online databases of patents relevant to their standards. Users are encouraged to consult the databases for the most up to date information concerning patents.

Company	Address
Samsung Electronics Co.Ltd.	416, Maetan-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, 152-848, Republic of Korea
Gwangju Institute of Science and Technology	261 Cheomdan - gwagiro (Oryong-dong), Buk-gu, Gwangju 500-712, Republic of Korea
Electronics and Telecommunications Research Institute (ETRI)	218 Gajeongno, Yuseong-gu, Daejeon, 305-700, Republic of Korea
Konkuk University	1 Hwayang-dong, Gwangjin-gu, Seoul, 143-701, Republic of Korea
Myongji University	116 Myongji-ro, Cheoin-gu, Yongin, 449-728, Republic of Korea

Information technology — Media context and control —

Part 2:
Control information

1 Scope

The technologies of this document specified are:

— description languages and vocabularies to characterize devices and users;

— control information to fine tune the sensed information and the actuator command for the control of virtual/real worlds, i.e., user's actuation preference information, user's sensor preference information, actuator capability description, and sensor capability description

The adaptation engine is not within the scope of this document.

This document specifies syntax and semantics of the tools required to provide interoperability in controlling devices (actuators and sensors) in real as well as virtual worlds:

— Control Information Description Language (CIDL) as an XML schema-based language which enables one to describe a basic structure of control information.

— Device Capability Description Vocabulary (DCDV), an XML representation for describing capabilities of actuators such as lamps, fans, vibrators, motion chairs, scent generators, etc.

— Sensor Capability Description Vocabulary (SCDV), interfaces for describing capabilities of sensors such as a light sensor, a temperature sensor, a velocity sensor, a global position sensor, an intelligent camera sensor, etc.

— Sensory Effect Preference Vocabulary (SEPV), interfaces for describing preferences of individual user on specific sensorial effects such as light, wind, scent, vibration, etc.

— Sensor Adaptation Preference Vocabulary (SAPV), interfaces for describing preferences on a sensor of an individual user on each type of sensed information.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited 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: —,[1] *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, abbreviated terms, schema documents and prefixes

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.2 Abbreviated terms

DIA	digital item adaptation (see ISO/IEC 21000-7)
MPEG-21	multimedia framework (ISO/IEC 21000-5)
CIDL	control information description language
DCDV	device capability description vocabulary
SCDV	sensor capability description vocabulary
SEPV	sensory effect preference vocabulary
SAPV	sensor adaptation preference vocabulary
XML	extensible mark-up language

3.3 Schema documents

In the main text of this document, the syntax of description schemes and descriptors is provided whenever possible as a single schema document.

In some cases, though, and in particular for Clauses 5, 6, 7 and 8, the syntax of description schemes and descriptors is provided as a collection of schema snippets imbricated with other text. In order to form a valid schema document, these schema components should be gathered in a same document with the schema wrapper provided at the head of the clause. For better readability, the relevant schema documents are provided in Annex B.

[1] Under preparation. Stage at time of publication: ISO/IEC DIS 23005-6:2017.

In all cases, each schema document has a `version` attribute, the value of which is "ISO/IEC 23005-2". Furthermore, an informative identifier is given as the value of the `id` attribute of the `schema` component. This identifier is non-normative and used as a convention in this document to reference another schema document. In particular, it is used for the `schemaLocation` attribute of the `include` and `import` schema components.

In addition, Annex A specifies a set of classification schemes that may be used by applications using description tools specified in this document.

3.4 Use of prefixes

For clarity, throughout this document, consistent namespace prefixes are used.

`"xsi:"` prefix is not normative. It is a naming convention in this document to refer to an element of the `http://www.w3.org/2001/XMLSchema-instance` namespace.

`"xml:"` and `"xmlns:"` are normative prefixes defined in [1]. The prefix `"xml:"` is by definition bound to `"http://www.w3.org/XML/1998/namespace"`. The prefix `"xmlns:"` is used only for namespace bindings and is not itself bound to any namespace name.

All other prefixes used in either the text or examples of this document are not normative, e.g., `"sedl:"`, `"sev:"`, `"dia:"`, `"si:"`, `"mpeg7:"`.

In particular, most of the informative examples in this document are provided as XML fragments without the normally required XML document declaration and, thus, miss a correct namespace binding context declaration. In these descriptions fragments, the different prefixes are bound to the namespaces as given in the Table 1.

Table 1 — Mapping of prefixes to namespaces in examples and text

Prefix	Corresponding namespace
ct	urn:mpeg:mpeg-v:2018:01-CT-NS
sedl	urn:mpeg:mpeg-v:2018:01-SEDL-NS
sev	urn:mpeg:mpeg-v:2018:01-SEV-NS
dia	urn:mpeg:mpeg21:2003:01-DIA-NS
si	urn:mpeg:mpeg21:2003:01-DIA-XSI-NS
mpeg7	urn:mpeg:mpeg7:schema:2004
xsi	http://www.w3.org/2001/XMLSchema-instance
xsd	http://www.w3.org/2001/XMLSchema

4 Control information description language

4.1 General

This subclause describes basic structure of the tools in this document 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 document 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:2018:01-CT-NS" xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS"
xmlns:dcdv="urn:mpeg:mpeg-v:2018:01-DCDV-NS" xmlns:scdv="urn:mpeg:mpeg-
v:2018:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-v:2018:01-SEPV-NS"
xmlns:sapv="urn:mpeg:mpeg-v:2018:01-SAPV-NS"
targetNamespace="urn:mpeg:mpeg-v:2018:01-CIDL-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-2" 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:2018:01-CT-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-CT.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2018:01-DCDV-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-DCDV.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2018:01-SCDV-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-SCDV.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2018:01-SEPV-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-SEPV.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2018:01-SAPV-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-SAPV.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 Mnemonics for binary representations

The mnemonics are defined in ISO/IEC 23005-6: —, 4.2.

4.4 Common header for binary representations

The common header is defined in ISO/IEC 23005-6: —, 4.3.

4.5 Root element and top-level tools

4.5.1 General

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 document is instantiated. The top-level tools are defined as the elements which are allowed to appear as the topmost element within the root element.

4.5.2 XML representation 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"/>
      <element name="SensorAdaptationPreferenceList"
         type="cidl:SensorAdaptationPreferenceListType" 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>

<complexType name="SensorAdaptationPreferenceListType">
   <sequence>
      <element name="SAPreference"
```

```
            type="cidl:SensorAdaptationPreferenceBaseType"
maxOccurs="unbounded"/>
    </sequence>
</complexType>
```

4.5.3 Binary representation syntax

ControlInfoType{	Number of bits	Mnemonic
SensoryDeviceCapabilityListFlag	1	bslbf
SensorDeviceCapabilityListFlag	1	bslbf
UserSensoryPreferenceListFlag	1	bslbf
SensorAdaptationPreferenceListFlag	1	bslbf
if (SensoryDeviceCapabilityListFlag) {		
SensoryDeviceCapabilityList		SensoryDeviceCapabilityListType
}		
if (SensorDeviceCapabilityListFlag) {		
SensorDeviceCapabilityList		SensorDeviceCapabilityListType
}		
if (UserSensoryPreferenceListFlag) {		
UserSensoryPreferenceList		UserSensoryPreferenceListType
}		
if (SensorAdaptationPreferenceListFlag) {		
SensorAdaptationPreferenceList		SensorAdaptationPreferenceListType
}		
}		
SensoryDeviceCapabilityListType {		
NumOfSensoryDevCap	32	uimsbf
for(i=1;i<NumOfSensoryDevCap;i++){		

ControlInfoType{	**Number of bits**	**Mnemonic**
IndividualSensoryDevCapType	8	bslbf
SensoryDeviceCapability		SensoryDeviceCapabilityType specified by IndividualSensoryDevCapType
}		
}		
SensorDeviceCapabilityListType {		
NumOfSensorCap	32	uimsbf
for(i=1;i<NumOfSensorCap;i++){		
IndividualSensorCapType	8	bslbf
SensorCapability		SensorCapabilityType specified by IndividualSensorCapType
}		
}		
UserSensoryPreferenceListType {		
NumOfUserSensoryPref	32	uimsbf
for(i=1;i<NumOfUserSensoryPref;i++){		
IndividualUserSensoryPrefType	8	bslbf
USPreference		USPreferenceType specified by IndividualUserSensoryPrefType
}		
}		
SensorAdaptationPreferenceListType {		

ControlInfoType{	Number of bits	Mnemonic
NumOfSensorAdaptationPref	32	uimsbf
for(i=1;i< NumOfSensorAdaptationPref;i++){		
IndividualSensorAdaptationPrefType	8	bslbf
SAPreference		SAPreferenceType specified by IndividualSensorAdaptationPrefType
}		
}		

4.5.4 Semantics

Semantics of the `ControlInfo` type .

Name	Definition
`ControlInfo`	The root element that serves as the topmost element in the control information description.
`SensoryDeviceCapabilityListFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`SensorDeviceCapabilityListFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`UserSensoryPreferenceListFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`SensorAdaptationPreferenceListFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
ControlInfoType	The root type provides basic structure that the control information description should follow through the root element. This field, which is present in the binary representation, indicates the type of the ControlInfo element. There should be used at least one element among ControlInfoType.
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.
SensorAdaptationPreferenceList	Optional wrapper element that serves as the placeholder for the list of sensor device adaptation preference descriptions.
SensoryDeviceCapabilityListType	Wrapper element type which allows multiple occurrences of sensory device capability descriptions.
NumOfSensoryDevCap	This field, which is only present in the binary representation, specifies the number of SensoryDeviceCapability instances accommodated in the SensoryDeviceCapabilityList.
IndividualSensoryDevCapType	This field, which is only present in the binary representation, describes which SensoryDeviceCapability type shall be used. In the binary description, the following mapping table is used,

Terms of device	Binary representation for device type (8 bits)
Light device	00000000
Flash device	00000001
Heating device	00000010
Cooling device	00000011
Wind device	00000100

Name	Definition	
	Vibration device	00000101
	Sprayer device	00000110
	Scent device	00000111
	Fog device	00001000
	Colour correction device	00001001
	Rigid body motion device	00001010
	Tactile device	00001011
	Kinesthetic device	00001100
	Mobile device position	00001101
	Bubble device	00001110
	3D printing device	00001111
	Arrayed light device	00010000
	Sound display device	00010001
	Reserved	00010010-11111111

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td>SensoryDeviceCapability</td><td>Specifies single description of sensory device capability description. The list of single device capabilities are as follows.
<table>
<tr><th>Terms of device</th><th>Device capability type</th></tr>
<tr><td>Light device</td><td>LightCapabilityType</td></tr>
<tr><td>Flash device</td><td>FlashCapabilityType</td></tr>
<tr><td>Heating device</td><td>HeatingCapabilityType</td></tr>
<tr><td>Cooling device</td><td>CoolingCapabilityType</td></tr>
<tr><td>Wind device</td><td>WindCapabilityType</td></tr>
<tr><td>Vibration device</td><td>VibrationCapabilityType</td></tr>
<tr><td>Sprayer device</td><td>SprayerCapabilityType</td></tr>
<tr><td>Scent device</td><td>ScentCapabilityType</td></tr>
<tr><td>Fog device</td><td>FogCapabilityType</td></tr>
<tr><td>Colour correction device</td><td>ColorCorrectionCapabilityType</td></tr>
<tr><td>Rigid body motion device</td><td>RigidBodyMotionCapabilityType</td></tr>
<tr><td>Tactile device</td><td>TactileCapabilityType</td></tr>
<tr><td>Kinesthetic device</td><td>KinestheticCapabilityType</td></tr>
<tr><td>Mobile device position</td><td>MobileDevicePositionCapabilityType</td></tr>
<tr><td>Bubble device</td><td>BubbleCapabilityType</td></tr>
<tr><td>3D printing device</td><td>ThreeDPrintingCapabilityType</td></tr>
<tr><td>Arrayed light device</td><td>ArrayedLightCapabilityType</td></tr>
<tr><td>Sound display device</td><td>SoundDisplayCapabilitytype</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td>SensoryDeviceCapabilityBaseType</td><td>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.</td></tr>
<tr><td>SensorDeviceCapabilityListType</td><td>Wrapper element type which allows multiple occurrences of sensor device capability descriptions.</td></tr>
<tr><td>NumOfSensorCap</td><td>This field, which is only present in the binary representation, specifies the number of SensorCapability instances accommodated in the SensorCapabilityList.</td></tr>
<tr><td>IndividualSensorCapType</td><td>This field, which is only present in the binary representation, describes which SensorCapability type shall be used.

In the binary description, the following mapping table is used,
<table>
<tr><th>Term of sensor capability</th><th>Binary representation for sensor type (8 bits)</th></tr>
<tr><td>Light sensor capability</td><td>00000000</td></tr>
<tr><td>Ambient noise sensor capability</td><td>00000001</td></tr>
<tr><td>Temperature sensor capability</td><td>00000010</td></tr>
<tr><td>Humidity sensor capability</td><td>00000011</td></tr>
<tr><td>Distance sensor capability</td><td>00000100</td></tr>
<tr><td>Atmospheric pressure Sensor capability</td><td>00000101</td></tr>
<tr><td>Position sensor capability</td><td>00000110</td></tr>
<tr><td>Velocity sensor capability</td><td>00000111</td></tr>
<tr><td>Acceleration sensor capability</td><td>00001000</td></tr>
<tr><td>Orientation sensor capability</td><td>00001001</td></tr>
</table></td></tr>
</table>

Name	Definition	
	Angular velocity sensor capability	00001010
	Angular acceleration sensor capability	00001011
	Force sensor capability	00001100
	Torque sensor capability	00001101
	Pressure sensor capability	00001110
	Motion sensor capability	00001111
	Intelligent camera sensor capability	00010000
	Bend sensor capability	00010001
	Gas sensor capability	00010010
	Dust sensor capability	00010011
	Multi interaction point sensor capability	00010100
	Gaze tracking sensor capability	00010101
	Global position sensor capability	00010110
	Altitude sensor capability	00010111
	Weather sensor capability	00011000
	Camera sensor capability	00011001
	Proximity sensor capability	00011010
	Body weight sensor capability	00011011
	Engine oil temperature sensor capability	00011100
	Intake air temperature sensor capability	00011101
	Tire pressure monitor system sensor capability	00011110

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td></td><td>
<table>
<tr><td>Distance travelled sensor capability</td><td>00011111</td></tr>
<tr><td>Speed sensor capability</td><td>00100000</td></tr>
<tr><td>Vehicle speed sensor capability</td><td>00100001</td></tr>
<tr><td>Mass air flow sensor capability</td><td>00100010</td></tr>
<tr><td>Fuel level sensor capability</td><td>00100011</td></tr>
<tr><td>Manifold absolute pressure sensor capability</td><td>00100100</td></tr>
<tr><td>EngineRPM sensor capability</td><td>00100101</td></tr>
<tr><td>Radar sensor capability</td><td>00100110</td></tr>
<tr><td>Array camera sensor capability</td><td>00100111</td></tr>
<tr><td>E-Nose sensor capability</td><td>00101000</td></tr>
<tr><td>Microphone sensor capability</td><td>00101001</td></tr>
<tr><td>Reserved</td><td>00101010-11111111</td></tr>
</table>
</td></tr>
<tr><td>SensorDeviceCapability</td><td>Specifies single description of sensor device capability description. The list of single sensor capabilities are as follows.
<table>
<tr><th>Term of sensor</th><th>Sensor capability type</th></tr>
<tr><td>Light sensor</td><td>LightSensorCapabilityType</td></tr>
<tr><td>Ambient noise sensor</td><td>AmbientNoiseSensorCapabilityType</td></tr>
<tr><td>Temperature sensor</td><td>TemperatureSensorCapabilityType</td></tr>
<tr><td>Humidity sensor</td><td>HumiditySensorCapabilityType</td></tr>
</table>
</td></tr>
</table>

Name	Definition	
	Distance sensor	DistanceSensorCapabilityType
	Atmospheric pressure Sensor	AtmosphericPressureSensorCapabilityType
	Position sensor	PositionSensorCapabilityType
	Velocity sensor	VelocitySensorCapabilityType
	Acceleration sensor	AccelerationSensorCapabilityType
	Orientation sensor	OrientationSensorCapabilityType
	Angular velocity sensor	AngularVelocitySensorCapabilityType
	Angular acceleration sensor	AngularAccelerationSensorCapabilityType
	Force sensor	ForceSensorCapabilityType
	Torque sensor	TorqueSensorCapabilityType
	Pressure sensor	PressureSensorCapabilityType
	Motion sensor	MotionSensorCapabilityType
	Intelligent camera sensor	IntelligentCameraCapabilityType
	Bend sensor	BendSensorCapabilityType
	Gas sensor	GasSensorCapabilityType
	Dust sensor	DustSensorCapabilityType

Name	Definition	
	Multi interaction point sensor	MultiInteractionPointSensorCapabilityType
	Gaze tracking sensor	GazeTrackingSensorCapabilityType
	Global position sensor	GlobalPositionSensorCapabilityType
	Altitude sensor	AltitudeSensorCapabilityType
	Weather sensor	WeatherSensorCapabilityType
	Camera sensor	CameraSensorCapabilityType
	Proximity sensor	ProximitySensorCapabilityType
	Body weight sensor	BodyWeightSensorCapabilityType
	Engine oil temperature sensor	EngineOilTemperatureSensorCapabilityType
	Intake air temperature sensor	IntakeAirTemperatureSensorCapabilityType
	Tire pressure monitor system sensor	TirePressureMonitorSystemSensorCapabilityType
	Distance travelled sensor	DistanceTraveledSensorCapabilityType
	Speed sensor	SpeedSensorCapabilityType
	Vehicle speed sensor	VehicleSpeedSensorCapabilityType
	Mass air flow sensor	MassAirFlowSensorCapabilityType

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td></td><td>
<table>
<tr><td>Fuel level sensor</td><td>FuelLevelSensorCapabilityType</td></tr>
<tr><td>Manifold absolute pressure sensor</td><td>ManifoldAbsolutePressureSensorCapabilityType</td></tr>
<tr><td>EngineRPM sensor</td><td>EngineRPMSensorCapabiityType</td></tr>
<tr><td>Radar sensor</td><td>RadarSensorCapabilityType</td></tr>
<tr><td>Array camera sensor</td><td>ArrayCameraSensorCapabilityType</td></tr>
<tr><td>E-Nose sensor</td><td>EnoseSensorCapabilityType</td></tr>
<tr><td>Microphone sensor</td><td>MicrophoneSensorCapabilityType</td></tr>
</table>
</td></tr>
<tr><td>SensorCapabilityBaseType</td><td>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.</td></tr>
<tr><td>UserSensoryPreferenceListType</td><td>Wrapper element type which allows multiple occurrences of user preference descriptions on sensory effects.</td></tr>
<tr><td>NumOfUserSensoryPref</td><td>This field, which is only present in the binary representation, specifies the number of USPreference instances accommodated in the UserSensoryPreferenceList.</td></tr>
<tr><td>IndividualUserSensoryPrefType</td><td>This field, which is only present in the binary representation, describes which USPreference type shall be used.

In the binary description, the following mapping table is used.
<table>
<tr><th>Terms of effect</th><th>Binary representation for effect type (8bits)</th></tr>
<tr><td>Light effect</td><td>00000000</td></tr>
<tr><td>Flash effect</td><td>00000001</td></tr>
</table>
</td></tr>
</table>

Name	Definition	
	Heating effect	00000010
	Cooling effect	00000011
	Wind effect	00000100
	Vibration effect	00000101
	Sprayer effect	00000110
	Scent effect	00000111
	Fog effect	00001000
	Colour correction effect	00001001
	Rigid body motion effect	00001010
	Tactile effect	00001011
	Kinesthetic effect	00001100
	Bubble effect	00001101
	3D printing effect	00001110
	3D printing colour reproduction effect	00001111
	Arrayed light effect	00010000
	Sound display effect	00010001
	Reserved	00010010-11111111

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td>USPreference</td><td>Specifies single description of user preference description on sensory effect. The list of single user preferences are as follows.
<table>
<tr><th>Terms of effect</th><th>Terms of user preference</th></tr>
<tr><td>Light effect</td><td>LightPrefType</td></tr>
<tr><td>Flash effect</td><td>FlashPrefType</td></tr>
<tr><td>Heating effect</td><td>HeatingPrefType</td></tr>
<tr><td>Cooling effect</td><td>CoolingPrefType</td></tr>
<tr><td>Wind effect</td><td>WindPrefType</td></tr>
<tr><td>Vibration effect</td><td>VibrationPrefType</td></tr>
<tr><td>Scent effect</td><td>ScentPrefType</td></tr>
<tr><td>Fog effect</td><td>FogPrefType</td></tr>
<tr><td>Spraying effect</td><td>SprayingPrefType</td></tr>
<tr><td>Colour correction effect</td><td>ColorCorrectionPrefType</td></tr>
<tr><td>Rigid body motion effect</td><td>RigidBodyMotionPrefType</td></tr>
<tr><td>Tactile effect</td><td>TactilePrefType</td></tr>
<tr><td>Kinesthetic effect</td><td>KinestheticPrefType</td></tr>
<tr><td>Bubble effect</td><td>BubblePrefType</td></tr>
<tr><td>3D printing effect</td><td>ThreeDPrintingPrefType</td></tr>
<tr><td>3D printing colour reproduction effect</td><td>ThreeDPrintingColorReproductionPrefType</td></tr>
<tr><td>Arrayed light effect</td><td>ArrayedLightPrefType</td></tr>
<tr><td>Sound display effect</td><td>SoundDisplayPrefType</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td>UserSensoryPreferenceBaseType</td><td>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.</td></tr>
<tr><td>SensorAdaptationPreferenceListType</td><td>Wrapper element type which allows multiple occurrences of user preference descriptions on sensor adaptation.</td></tr>
<tr><td>NumOfSensorAdaptationPref</td><td>This field, which is only present in the binary representation, specifies the number of SAPreference instances accommodated in the SensorAdaptationPreferenceList.</td></tr>
<tr><td>IndividualSensorAdaptationPrefType</td><td>This field, which is only present in the binary representation, describes which SAPreference type shall be used.

In the binary description, the following mapping table is used.
<table>
<tr><th>Term of sensor adaptation preference</th><th>Binary representation for sensor type (8bits)</th></tr>
<tr><td>Light sensor adaptation preference</td><td>00000000</td></tr>
<tr><td>Ambient noise sensor adaptation preference</td><td>00000001</td></tr>
<tr><td>Temperature sensor adaptation preference</td><td>00000010</td></tr>
<tr><td>Humidity sensor adaptation preference</td><td>00000011</td></tr>
<tr><td>Distance sensor adaptation preference</td><td>00000100</td></tr>
<tr><td>Atmospheric pressure sensor adaptation preference</td><td>00000101</td></tr>
<tr><td>Position sensor adaptation preference</td><td>00000110</td></tr>
<tr><td>Velocity sensor adaptation preference</td><td>00000111</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Name</th><th colspan="2">Definition</th></tr>
<tr><td></td><td>Acceleration sensor adaptation preference</td><td>00001000</td></tr>
<tr><td></td><td>Orientation sensor adaptation preference</td><td>00001001</td></tr>
<tr><td></td><td>Angular velocity sensor adaptation preference</td><td>00001010</td></tr>
<tr><td></td><td>Angular acceleration sensor adaptation preference</td><td>00001011</td></tr>
<tr><td></td><td>Force sensor adaptation preference</td><td>00001100</td></tr>
<tr><td></td><td>Torque sensor adaptation preference</td><td>00001101</td></tr>
<tr><td></td><td>Pressure sensor adaptation preference</td><td>00001110</td></tr>
<tr><td></td><td>Motion sensor adaptation preference</td><td>00001111</td></tr>
<tr><td></td><td>Intelligent camera sensor adaptation preference</td><td>00010000</td></tr>
<tr><td></td><td>Radar sensor adaptation preference</td><td>00010001</td></tr>
<tr><td></td><td>Array camera sensor dapatation preference</td><td>00010010</td></tr>
<tr><td></td><td>Reserved</td><td>00010011-11111111</td></tr>
<tr><td>SAPreference</td><td colspan="2">Specifies single description of user preference description on sensor adaptation. The list of single sensor adaptation preferences are as follows:
<table>
<tr><th>Term of sensor</th><th>Sensor adaptation preference type</th></tr>
<tr><td>Light sensor</td><td>LightAdaptationPrefType</td></tr>
<tr><td>Ambient noise sensor</td><td>AmbientNoiseAdaptationPrefType</td></tr>
<tr><td>Temperature sensor</td><td>TemperatureAdaptationPrefType</td></tr>
</table></td></tr>
</table>

Name	Definition	
	Humidity sensor	HumidityAdaptationPrefType
	Distance sensor	DistanceAdaptationPrefType
	Atmospheric pressure Sensor	AtmosphericPressureAdaptationPrefType
	Position sensor	PositionAdaptationPrefType
	Velocity sensor	VelocityAdaptationPrefType
	Acceleration sensor	AccelerationAdaptationPrefType
	Orientation sensor	OrientationAdaptationPrefType
	Angular velocity sensor	AngularVelocityAdaptationPrefType
	Angular acceleration sensor	AngularAccelerationAdaptationPrefType
	Force sensor	ForceAdaptationPrefType
	Torque sensor	TorqueAdaptationPrefType
	Pressure sensor	PressureAdaptationPrefType
	Motion sensor	MotionAdaptationPrefType
	Intelligent camera sensor	IntelligentCameraAdaptationPrefType
	Radar sensor	RadarAdaptationPrefType
	Array camera sensor	ArrayCameraAdaptationPrefType

Name	Definition
SensorAdaptationPreferenceBaseType	SensorAdaptationPreferenceBaseType 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.

4.5.5 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:2018:01-CIDL-NS
CIDL.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-
v:2018:01-DCDV-NS" xmlns:sapv="urn:mpeg:mpeg-v:2018:01-SAPV-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2018:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-
v:2018:01-SEPV-NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2018:01-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:2018:01-CIDL-NS
CIDL.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-
v:2018:01-DCDV-NS" xmlns:sapv="urn:mpeg:mpeg-v:2018:01-SAPV-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2018:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-
v:2018:01-SEPV-NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2018:01-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:2018:01-CIDL-NS
CIDL.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-
v:2018:01-DCDV-NS" xmlns:sapv="urn:mpeg:mpeg-v:2018:01-SAPV-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2018:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-
v:2018:01-SEPV-NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2018:01-CT-NS">
   <cidl:UserSensoryPreferenceList>
      <cidl:USPreference xsi:type="sepv:CoolingPrefType">
         . . .
      </cidl:USPreference>
      . . .
   </cidl:UserSensoryPreferenceList>
</cidl:ControlInfo>
```

The following example shows an instantiation of SensorAdaptationPreferenceList. The SensorAdaptationPreferenceList allows multiple occurrences of SAPreference elements. For the details of SAPreference, please see the examples of user's preference on individual sensor adaptation.

```
<cidl:ControlInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2018:01-CIDL-NS
CIDL.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS" xmlns:dcdv="urn:mpeg:mpeg-
v:2018:01-DCDV-NS" xmlns:sapv="urn:mpeg:mpeg-v:2018:01-SAPV-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2018:01-SCDV-NS" xmlns:sepv="urn:mpeg:mpeg-
v:2018:01-SEPV-NS">
   <cidl:SensorAdaptationPreferenceList>
      <cidl:SAPreference
xsi:type="sapv:IntelligentCameraAdaptationPrefType">
         . . .
      </cidl:SAPreference>
      . . .
   </cidl:SensorAdaptationPreferenceList>
</cidl:ControlInfo>
```

4.6 Sensory device capability description

4.6.1 General

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.

4.6.2 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.

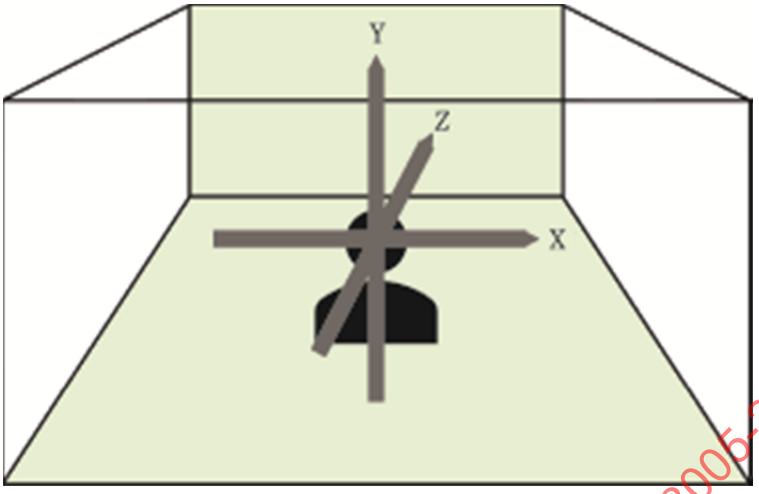


Figure 2 — Reference coordinate system for sensory devices

4.6.3 Sensory device capability base type

4.6.3.1 XML representation syntax

```
<complexType name="SensoryDeviceCapabilityBaseType" abstract="true">
   <complexContent>
      <extension base="dia:TerminalCapabilityBaseType">
         <attributeGroup ref="cidl:sensoryDeviceCapabilityAttributes"/>
      </extension>
   </complexContent>
</complexType>
```

4.6.3.2 Binary representation syntax

SensoryDeviceCapabilityBaseType{	**Number of bits**	**Mnemonic**
TerminalCapabilityBase		TerminalCapabilityBaseType
sensoryDeviceCapabilityAttributes		sensoryDeviceCapabilityAttributesType
}		

4.6.3.3 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.

Name	Definition
sensoryDeviceCapability Attributes	Describes a group of attributes for the device capabilities.

4.6.4 Sensory device capability base attributes

4.6.4.1 XML representation syntax

```
<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>
```

4.6.4.2 Binary representation syntax

sensoryDeviceCapabilityAttributes {	Number of bits	Mnemonic
zerothOrderDelayTimeFlag	1	bslbf
firstOrderDelayTimeFlag	1	bslbf
locatorFlag	1	bslbf
if(zerothOrderDelayTimeFlag){		
zerothOrderDelayTime	16	uimsbf
}		
if(firstOrderDelayTimeFlag){		
firstOrderDelayTime	16	uimsbf
}		
if(locatorFlag){		
locator	7	blsbf
}		
}		

4.6.4.3 Semantics

Semantics of the `sensoryDeviceCapabilityAttributes` type.

Name	Definition
sensoryDeviceCapability Attributes	Describes a group of attributes for the sensory device capabilities.
zerothOrderDelayTimeFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
firstOrderDelayTimeFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
locatorFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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 ISO/IEC 23005-6: —, A.2.3.

4.6.4.4 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 ISO/IEC 23005-6: —, A.2.3.

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


4.7 Sensor capability description

4.7.1 General

This subclause specifies tools for describing sensor capability of individual sensors. In 4.7.2, the global coordinate for sensors which depends on the real world environment of user to determine the location of the sensors is defined. In 4.7.3, an abstract complex type of SensorCapabilityBaseType is defined, which the sensor capability description of individual device should inherit.

4.7.2 Global coordinate for sensors

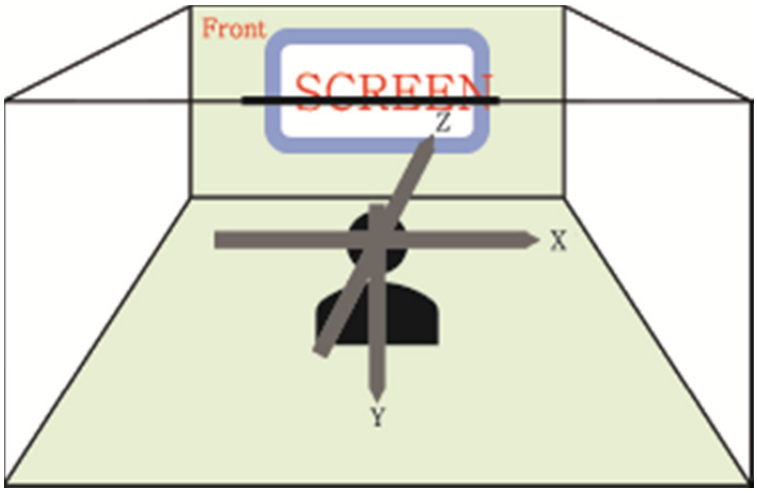


Figure 3 — Global coordinate for sensors

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.

4.7.3 Sensor capability base type

4.7.3.1 XML representation syntax

```
<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>
```

4.7.3.2 Binary representation syntax

SensorCapabilityBaseType {	Number of bits	Mnemonic
AccuracyFlag	1	bslbf
TerminalCapabilityBase		TerminalCapabilityBaseType
if(AccuracyFlag){		
Accuracy		AccuracyType
}		
SensorCapabilityBaseAttributes		SensorCapabilityBaseAttributesType
}		
AccuracyType {		
AccuracySelect	2	bslbf
if(AccuracySelect==00){		
PercentAccuracy	32	fsbf
} else if (AccuracySelect==01) {		
ValueAccuracy	32	fsbf
}		
}		

4.7.3.3 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.
`AccuracyFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

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.
AccuracySelect	This field, which is only present in the binary representation, describes which accuracy scheme shall be used. "0" means that the PercentAccuracy type shall be used, and "1" means that the ValueAccuracy type shall be used.
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.

4.7.3.4 Examples

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

4.7.4 Sensor capability base attributes

4.7.4.1 XML representation syntax

```
<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>
```

4.7.4.2 Binary representation syntax

SensorCapabilityBaseAttributesType {	Number of bits	Mnemonic
unitFlag	1	bslbf
maxValueFlag	1	bslbf
minValueFlag	1	bslbf
offsetFlag	1	bslbf
numOfLevelsFlag	1	bslbf
sensitivityFlag	1	bslbf
SNRFlag	1	bslbf
if(unitFlag){		
unit	8	bslbf
}		
if(maxValueFlag){		
maxValue	32	fsbf
}		
if(minValueFlag){		
minValue	32	fsbf
}		
if(offsetFlag){		
offset	32	fsbf
}		
if(numOfLevelsFlag){		
numOfLevels	16	uimsbf
}		
if(sensitivityFlag){		
sensitivity	32	fsbf
}		

SensorCapabilityBaseAttributesType {	Number of bits	Mnemonic
if(SNRFlag){		
SNR	32	fsbf
}		
}		

4.7.4.3 Semantics

Semantics of the `SensorCapabilityBaseAttributes`.

Name	Definition
`sensorCapabilityBaseAttributes`	Describes a group of attributes for the sensor capabilities.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxValueFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`minValueFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`offsetFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`numOfLevelsFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`sensitivityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`SNRFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
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 ISO/IEC 23005-6: —, A.2.1, 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.

4.7.4.4 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="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-
NS:dB"/>
```

4.8 User's sensory preference description

4.8.1 General

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.

4.8.2 User sensory preference base type

4.8.2.1 XML representation syntax

```
<complexType name="UserSensoryPreferenceBaseType" abstract="true">
   <complexContent>
      <extension base="dia:UserCharacteristicBaseType">
         <attributeGroup ref="cidl:userSensoryPrefBaseAttributes"/>
      </extension>
   </complexContent>
</complexType>
```

4.8.2.2 Binary representation syntax

UserSensoryPreferenceBaseType {	Number of bits	Mnemonic
UserCharacteristicBase		UserCharacteristicBaseType
userSensoryPrefBaseAttributes		userSensoryPrefBaseAttributesType
}		

4.8.2.3 Semantics

Semantics of the `UserSensoryPreferenceBaseType` type:

Name	Definition
`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.
`userSensoryPrefBaseAttributes`	Describes a group of common attributes for the describing user preferences on sensory experience.

4.8.2.4 Examples

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

4.8.3 User sensory preference base attributes

4.8.3.1 XML representation syntax

```
<attributeGroup name="userSensoryPrefBaseAttributes">
   <attribute name="adaptationMode" type="cidl:adaptationModeType"
      use="optional"/>
   <attribute name="activate" type="boolean" use="optional"/>
</attributeGroup>

<simpleType name="adaptationModeType">
   <restriction base="string">
      <enumeration value="strict"/>
```

```
      <enumeration value="scalable"/>
   </restriction>
</simpleType>
```

4.8.3.2 Binary representation syntax

userSensoryPrefBaseAttributesType {	Number of bits	Mnemonic
AdaptationModeFlag	1	bslbf
ActivateFlag	1	bslbf
if(adaptationModeFlag){		
adaptationMode		adaptationModeType
}		
if(activateFlag){		
activate	1	bslbf
}		
}		
adaptationModeType {		
AdaptationMode	2	bslbf
}		

4.8.3.3 Semantics

Semantics of the `userSensoryPrefBaseAttributes` type.

Name	Definition
`userSensoryPrefBaseAttributes`	Describes a group of common attributes for the describing user preferences on sensory experience.
`adaptationModeFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`activateFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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

Name	Definition
	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. In the binary description, the following mapping table is used. adaptationModeType / adaptationMode 00 / strict 01 / scalable 10-11 / Reserved

4.8.3.4 Examples

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

4.9 Sensor adaptation preference description

4.9.1 General

This subclause specifies tools for describing preferences of individual users regarding the sensed information. The following subclauses define an abstract complex type of SensorAdaptationPreferenceBaseType, which the user preferences on each individual type of sensed information should inherit.

4.9.2 Sensor adaptation preference base type

4.9.2.1 XML representation syntax

```
<complexType name="SensorAdaptationPreferenceBaseType" abstract="true">
   <complexContent>
      <extension base="dia:UserCharacteristicBaseType">
         <attributeGroup ref="cidl:sensorAdaptationPrefBaseAttributes"/>
      </extension>
   </complexContent>
</complexType>
```

4.9.2.2 Binary representation syntax

SensorAdaptationPreferenceBaseType {	Number of bits	Mnemonic
UserCharacteristicBase		UserCharacteristicBaseType
sensorAdaptationPrefBaseAttributes		sensorAdaptationPrefBaseAttributesType
}		

4.9.2.3 Semantics

Semantics of the `SensorAdaptationPreferenceBaseType` type.

Name	Definition
`SensorAdaptationPreferenceBaseType`	`SensorAdaptationPreferenceBaseType` 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 sensor capability metadata types.
`SensorAdaptationPrefBaseAttributes`	Describes a group of common attributes for describing the adaptation preferences on sensed information.

4.9.2.4 Examples

For the examples of `SensorAdaptationPreferenceBaseType`, please see the examples of preferences on individual sensor adaptation preference type.

4.9.3 Sensor adaptation preference base attributes

4.9.3.1 XML representation syntax

```
<attributeGroup name="sensorAdaptationPrefBaseAttributes">
   <attribute name="sensorIdRef" type="anyURI" use="optional"/>
   <attribute name="sensorAdaptationMode"
type="cidl:sensorAdaptationModeType" use="optional"/>
   <attribute name="activate" type="boolean" use="optional"/>
   <attribute name="unit" type="mpegvct:unitType" use="optional"/>
   <attribute name="maxValue" type="float" use="optional"/>
   <attribute name="minValue" type="float" use="optional"/>
   <attribute name="numOfLevels" type="nonNegativeInteger"
use="optional"/>
</attributeGroup>

<simpleType name="sensorAdaptationModeType">
   <restriction base="string">
      <enumeration value="strict"/>
      <enumeration value="scalable"/>
   </restriction>
</simpleType>
```

4.9.3.2 Binary representation syntax

sensorAdaptationPrefBaseAttributesType {	Number of bits	Mnemonic
sensorIdRefFlag	1	bslbf
sensorAdaptationModeFlag	1	bslbf
activateFlag	1	bslbf
unitFlag	1	bslbf
maxValueFlag	1	bslbf
minValueFlag	1	bslbf
numOfLevelsFlag	1	bslbf
if(sensorIdRefFlag) {		
sensorIdRef	See ISO/IEC 10646[4]	UTF-8
}		
if(sensorAdaptationModeFlag) {		
sensorAdaptationMode		sensorAdaptationModeType
}		
if(activateFlag) {		
activate	1	bslbf
}		
if(unitFlag) {		
unit	8	bslbf
}		
if(maxValueFlag) {		
maxValue	32	fsbf
}		
if(minValueFlag) {		
minValue	32	fsbf

sensorAdaptationPrefBaseAttributesType {	Number of bits	Mnemonic
}		
if(numOfLevelsFlag) {		
numOfLevels		vluimsbf5
}		
}		
sensorAdaptationModeType {		
sensorAdaptationMode	2	bslbf
}		

4.9.3.3 Semantics

Semantics of the `SensorAdaptatinPrefBaseAttributes` type.

Name	Definition
`SensorAdaptationPrefBaseAttributes`	Describes a group of common attributes for the describing adaptation preferences on sensed information.
`sensorIdRefFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`sensorAdaptationModeFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`activateFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxValueFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`minValueFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`numOfLevelsFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute

Name	Definition
	shall be used and "0" means the attribute shall not be used.
sensorIdRef	Refers the Id of an individual sensor that has generated the specific sensor adaptation preferences.
sensorAdaptationMode	Describes the user's preference on the adaptation method for the sensed information. EXAMPLE The value "strict" means the user prefer to transmit sensed information tothe virtual world exactly as described. Otherwise, the value "scalable" means to let the virtual world may adjust sensed information with scaled value according to user's intention.
activate	Describes whether the user allows the sensed information to be used or not. A value of "true" means the sensed information is allowed to use and "false" means the sensed information is not allowed to use.
unit	Describes the unit of value which the user prefers to adapt.
maxValue	Describes the maximum desirable value of the sensed information according to the maximum scale defined within the semantics definition of the individual sensor.
minValue	Describes the minimum desirable value of the sensed information according to the minimum scale defined within the semantics definition of the individual sensor.
numOfLevelsnumOfLevels	Describes the desirable number of value levels in between maximum and minimum value.
sensorAdaptationModeType	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.

4.9.3.4 Examples

For the examples of sensorAdaptationPrefBaseAttributes, please see the examples of preferences on individual sensor adaptation preference type.

5 Device capability description vocabulary

5.1 General

This sublause describes syntax and semantics of the device capability description vocabulary which comprises the following devices:

— light, coloured light, flash light device;

— heating, cooling device;

— wind device;

— vibration device;

— scent device;

— fog device;

— sprayer device;

— colour correction device;

— tactile device;

— kinesthetic device;

— rigid body motion device;

— mobile device position;

— bubble device;

— 3D printing device;

— arrayed light device;

— sound display device.

NOTE DCDV has been designed in an extensible way and additional device capabilities can be added easily.

5.2 Schema wrapper conventions

The syntax defined in this sublause 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:2018:01-CT-NS" xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS"
xmlns:dcdv="urn:mpeg:mpeg-v:2018:01-DCDV-NS"
targetNamespace="urn:mpeg:mpeg-v:2018:01-DCDV-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-2" 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:2018:01-CIDL-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/CIDL.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2018:01-CT-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-CT.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 General

This subclause specifies syntax and semantics of lighting capabilities of lighting devices.

5.3.2 XML representation syntax

```
<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>
```

5.3.3 Binary representation syntax

LightCapabilityType {	Number of bits	Mnemonic
ColorFlag	1	bslbf
unitFlag	1	bslbf
maxIntensityFlag	1	bslbf
numOfLightLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(ColorFlag){		
LoopColor		vluimsbf5
for(k=0;k<LoopColor;k++){		
Color[k]		ColorType
}		

LightCapabilityType {	Number of bits	Mnemonic
}		
if(unitFlag){		
unit	8	bslbf
}		
if(maxIntensityFlag){		
maxIntensity	32	uimsbf
}		
if(numOfLightLevelsFlag){		
numOfLightLevels	16	uimsbf
}		
}		

5.3.4 Semantics

Semantics of the `LightCapabilityType` type.

Name	Definition
`LightCapabilityType`	Tool for describing a light capability.
`ColorFlag`	This field, which is only present in the binary representation, signals the presence of the `Color`. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the `unit`. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the `maxIntensity`. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`numOfLightLevelsFlag`	This field, which is only present in the binary representation, signals the presence of the `numOfLightLevels`. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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 ISO/IEC 23005-6: —, A.2.1.

Name	Definition
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.
LoopColor	This field, which is only present in the binary representation, specifies the number of colours contained in the description.
Color	Describes the list of colours 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 ISO/IEC 23005-6: —, A.2.2. EXAMPLE urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue would describe the colour Alice blue.

5.3.5 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 ISO/IEC 23005-3:2018, Figure 3. The colours that can be displayed by the light are "white", "red", "blue", and "green" from the classification scheme described in ISO/IEC 23005-6: —, A.2.2.

```
<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-
LocationCS-NS:right">
   <dcdv:Color>
   urn:mpeg:mpeg-v:01-SI-ColorCS-NS:white
   </dcdv:Color>
   <dcdv:Color>
   urn:mpeg:mpeg-v:01-SI-ColorCS-NS:red
   </dcdv:Color>
   <dcdv:Color>
   urn:mpeg:mpeg-v:01-SI-ColorCS-NS:blue
   </dcdv:Color>
   <dcdv:Color>
   urn:mpeg:mpeg-v:01-SI-ColorCS-NS:green_color_wheel_x11_green
   </dcdv:Color>
</cidl:SensoryDeviceCapability>
```

5.4 Flash capability type

5.4.1 General

This subclause specifies syntax and semantics of flash capabilities of lighting devices.

5.4.2 XML representation syntax

```
<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>
```

5.4.3 Binary representation syntax

FlashCapabilityType {	Number of bits	Mnemonic
maxFrequencyFlag	1	bslbf
numOfFreqLevelsFlag	1	bslbf
LightCapability		LightCapabilityType
if(maxFrequencyFlag){		
maxFrequency	8	uimsbf
}		
if(numOfFreqLevelsFlag){		
numOfFreqLevels	8	uimsbf
}		
}		

5.4.4 Semantics

Semantics of the `FlashCapabilityType` type.

Name	Definition
`FlashCapabilityType`	Tool for describing a flash capability. It is extended from the light capability type.
`maxFrequencyFlag`	This field, which is only present in the binary representation, signals the presence of the `maxFrequency`. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`numOfFreqLevelsFlag`	This field, which is only present in the binary representation, signals the presence of the `numOfFreqLevels`. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
LightCapability	Describes a light capability.
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 ISO/IEC 23005-6: —, A.2.1.
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.

5.4.5 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 ISO/IEC 23005-3:2018, Figure 3.

```
<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" locator="urn:mpeg:mpeg-v:01-SI-LocationCS-
NS:left"/>
```

5.5 Heating capability type

5.5.1 General

This subclause specifies syntax and semantics of capabilities of heating devices.

5.5.2 XML representation syntax

```
<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>
```

5.5.3 Binary representation syntax

HeatingCapabilityType {	Number of bits	Mnemonic
maxIntensityFlag	1	bslbf
minIntensityFlag	1	bslbf
unitFlag	1	bslbf
numOfLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(maxIntensityFlag){		
maxIntensity	16	uimsbf
}		
if(minIntensityFlag){		
minIntensity	8	uimsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
if(numOfLevelsFlag){		
numOfLevels	16	uimsbf
}		
}		

5.5.4 Semantics

Semantics of the `HeatingCapabilityType` type.

Name	Definition
`HeatingCapabilityType`	Tool for describing the capability of a device which can increae the room temperature.

Name	Definition
maxIntensityFlag	This field, which is only present in the binary representation, signals the presence of the maxIntensity. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
minIntensityFlag	This field, which is only present in the binary representation, signals the presence of the minIntensity. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of the unit. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfLevelsFlag	This field, which is only present in the binary representation, signals the presence of the numOfLevels. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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 ISO/IEC 23005-6: —, A.2.16 (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.

5.5.5 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 °C, and the minimum intensity is 20 °C. 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 ISO/IEC 23005-3: —, Figure 3.

```
<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-LocationCS-NS:left"/>
```

5.6 Cooling capability type

5.6.1 General

This subclause specifies syntax and semantics of capabilities of cooling devices.

5.6.2 XML representation syntax

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

5.6.3 Binary representation syntax

CoolingCapabilityType {	Number of bits	Mnemonic
maxIntensityFlag	1	bslbf
minIntensityFlag	1	bslbf
unitFlag	1	bslbf
numOfLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(maxIntensityFlag){		
maxIntensity	16	simsbf
}		
if(minIntensityFlag){		
minIntensity	8	uimsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
if(numOfLevelsFlag){		
numOfLevels	16	uimsbf
}		
}		

5.6.4 Semantics

Semantics of the `CoolingCapabilityType` type.

Name	Definition
CoolingCapabilityType	Tool for describing the capability of a device which can decrease the room temperature.
maxIntensityFlag	This field, which is only present in the binary representation, signals the presence of the maxIntensity. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
minIntensityFlag	This field, which is only present in the binary representation, signals the presence of the minIntensity. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of the unit. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfLevelsFlag	This field, which is only present in the binary representation, signals the presence of the numOfLevels. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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 ISO/IEC 23005-6: —, A.2.1 (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.

5.6.5 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 °C, and the minimum intensity is 30 °C. This specified device can support 30 levels in controlling the intensity. This device takes 10 ms to start and 30 ms to reach the target intensity. The location of the heating device is the right side according to the position model described in ISO/IEC 23005-3: —, Figure 3.

```
<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-LocationCS-NS:right"/>
```

5.7 Wind capability type

5.7.1 General

This subclause specifies syntax and semantics of capabilities of wind generating devices.

5.7.2 XML representation syntax

```
<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>
```

5.7.3 Binary representation syntax

WindCapabilityType {	Number of bits	Mnemonic
maxWindSpeedFlag	1	bslbf
unitFlag	1	bslbf
numOfLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(maxWindSpeedFlag){		
maxWindSpeed	16	uimsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
if(numOfLevelsFlag){		
numOfLevels	16	uimsbf
}		
}		

5.7.4 Semantics

Semantics of the `WindCapabilityType` type.

Name	Definition
`WindCapabilityType`	Tool for describing a wind capability.

Name	Definition
maxWindSpeedFlag	This field, which is only present in the binary representation, signals the presence of the maxWindSpeed. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only prsent in the binary representation, signals the presence of the unit. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfLevelsFlag	This field, which is only present in the binary representation, signals the presence of the numOfLevels. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxWindSpeed	Describes the maximum wind speed that the fan can provide in terms of metre 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 ISO/IEC 23005-6: —, A.2.1.
numOfLevels	Describes the number of wind speed levels that the device can provide in between maximum and minimum speed.

5.7.5 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 metre 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 centre according to the position model described in ISO/IEC 23005-3:2018, Figure 3.

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

5.8 Vibration capability type

5.8.1 General

This subclause specifies syntax and semantics of capabilities of vibration generating devices.

5.8.2 XML representation syntax

```
<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>
```

5.8.3 Binary representation syntax

VibrationCapabilityType {	Number of bits	Mnemonic
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
numOfLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(maxIntensityFlag){		
maxIntensity	16	uimsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
if(numOfLevelsFlag){		
numOfLevels	16	uimsbf
}		
}		

5.8.4 Semantics

Semantics of the `VibrationCapabilityType` type.

Name	Definition
`VibrationCapabilityType`	Tool for describing a vibration capability.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.

Name	Definition
numOfLevelsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxIntensity	Describes the maximum intensity that the vibrator device can provide in terms of Hertz.
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 ISO/IEC 23005-6: —, A.2.1.
numOfLevels	Describes the number of intensity levels that the device can provide in between zero and maximum intensity.

5.8.5 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 600 Hz. 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 centre side according to the position model described in ISO/IEC 23005-3:2018, Figure 3.

```
<cidl:SensoryDeviceCapability xsi:type="sedv:VibrationCapabilityType"
id="vib001" zerothOrderDelayTime="0" firstOrderDelayTime="10"
maxIntensity="600" numOfLevels="4" locator="urn:mpeg:mpeg-v:01-SI-
LocationCS-NS:center"/>
```

5.9 Scent capability type

5.9.1 General

This subclause specifies syntax and semantics of capabilities of scent generating devices.

5.9.2 XML representation syntax

```
<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>
```

5.9.3 Binary representation syntax

ScentCapabilityType {	Number of bits	Mnemonic
ScentFlag	1	bslbf
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
numOfLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(ScentFlag){		
LoopScent		vluimsbf5
for(k=0;k<LoopScent;k++){		
Scent[k]	9	bslbf
}		
}		
if(maxIntensityFlag){		
maxIntensity	16	uimsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
if(numOfLevelsFlag){		
numOfLevels	16	uimsbf
}		
}		

5.9.4 Semantics

Semantics of the `ScentCapabilityType` type.

Name	Definition
`ScentCapabilityType`	Tool for describing a scent capability.
`ScentFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`numOfLevelsFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`LoopScent`	This field, which is only present in the binary representation, specifies the number of Scent contained in the description.
`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 ISO/IEC 15938-5:2003, 7.6. A CS that may be used for this purpose is the `ScentCS` defined in ISO/IEC 23005-6: —, A.2.4.
`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 ISO/IEC 23005-6: —, A.2.1. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in ISO/IEC 15938-5:2003, 7.6.
`numOfLevels`	Describes the number of intensity levels of the scent that the device can provide in between zero and maximum intensity.

5.9.5 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 centre side according to the position model described in ISO/IEC 23005-3:2018, Figure 3. The type of scent is rose according to the ScentCS specified in ISO/IEC 23005-6: —, A.2.4.

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

5.10 Fog capability type

5.10.1 General

This subclause specifies syntax and semantics of capabilities of fog generating devices.

5.10.2 XML representation syntax

```
<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>
```

5.10.3 Binary representation syntax

FogCapabilityType {	Number of bits	Mnemonic
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
numOfLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(maxIntensityFlag){		
maxIntensity	16	uimsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
if(numOfLevelsFlag){		
numOfLevels	16	uimsbf

FogCapabilityType {	Number of bits	Mnemonic
}		
}		

5.10.4 Semantics

Semantics of the `FogCapabilityType` type.

Name	Definition
`FogCapabilityType`	Tool for describing a fog capability.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`numOfLevelsFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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 ISO/IEC 23005-6: —, A.2.1. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in ISO/IEC 15938-5:2003, 7.6.
`numOfLevels`	Describes the number of intensity levels of the fog that the device can provide in between zero and maximum intensity.

5.10.5 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 ISO/IEC 23005-3:2018, Figure 3.

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

5.11 Sprayer capability type

5.11.1 General

This subclause specifies syntax and semantics of capabilities of spraying devices.

5.11.2 XML representation syntax

```
<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>
```

5.11.3 Binary representation syntax

SprayerCapabilityType {	**Number of bits**	**Mnemonic**
...sprayingFlag	1	bslbf
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
numOfLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(sprayingFlag) {		
spraying	8	blsbf
}		
if(maxIntensityFlag){		
maxIntensity	16	uimsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
if(numOfLevelsFlag){		

SprayerCapabilityType {	Number of bits	Mnemonic
numOfLevels	16	uimsbf
}		
}		

5.11.4 Semantics

Semantics of the `SprayerCapabilityType` type.

Name	Definition
`SprayerCapabilityType`	Tool for describing a water sprayer capability.
`sprayingFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`numOfLevelsFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`spraying`	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 ISO/IEC 15938-5:2003, 7.6. A CS that may be used for this purpose is the `SprayingTypeCS` defined in ISO/IEC 23005-6: —, A.2.7.
`maxIntensity`	Describes the maximum intensity that the water sprayer can provide in terms of ml/h.

Name	Definition
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 ISO/IEC 23005-6: —, A.2.1. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
numOfLevels	Describes the number of intensity levels of the fog that the device can provide in between zero and maximum intensity.

5.11.5 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 ISO/IEC 23005-3:2018, Figure 3.

```
<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-LocationCS-NS:midway"/>
```

5.12 Colour correction capability type

5.12.1 General

This subclause specifies syntax and semantics of capabilities of colour correction enabled devices.

5.12.2 XML representation syntax

```
<complexType name="ColorCorrectionCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <attribute name="flag" type="boolean" use="optional"
default="false"/>
      </extension>
   </complexContent>
</complexType>
```

5.12.3 Binary representation syntax

ColorCorrectionCapabilityType {	Number of bits	Mnemonic
flagFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(flagFlag) {		

flag	1	bslbf
}		
}		

5.12.4 Semantics

Semantics of the `ColorCorrectionCapabilityType` type.

Name	Definition
`ColorCorrectionCapabilityType`	Tool for describing if the given device has a colour correction capability.
`flagFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`flag`	Describes the existence of the colour correction capability of the given device in terms of "true" and "false".

5.12.5 Examples

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

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

5.13 Tactile capability type

5.13.1 General

This subclause specifies syntax and semantics of capabilities of tactile devices.

5.13.2 XML representation syntax

```
<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="nonNegativeInteger"/>
         <attribute name="arraysizeY" type="nonNegativeInteger"/>
         <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="nonNegativeInteger"
            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>
```

5.13.3 Binary representation syntax

TactileCapabilityType {	Number of bits	Mnemonic
intensityUnitFlag	1	bslbf
maxValueFlag	1	bslbf
minValueFlag	1	bslbf
arraysizeXFlag	1	bslbf
arraysizeYFlag	1	bslbf
gapXFlag	1	bslbf
gapYFlag	1	bslbf
gapUnitFlag	1	bslbf
maxUpdateRateFlag	1	bslbf
updateRateUnitFlag	1	bslbf
actuatorTypeFlag	1	bslbf
numOfLevelsFlag	1	bslbf
extendArraySizeFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(intensityUnitFlag) {		
intensityUnit	8	bslbf
}		
if(maxValueFlag){		
maxValue	16	uimsbf

TactileCapabilityType {	Number of bits	Mnemonic
}		
if(minValueFlag){		
minValue	16	uimsbf
}		
if(arraysizeXFlag){		
if(extendArraySizeFlag){		
arraysizeX	16	uimsbf
}		
else {		
arraysizeX	8	uimsbf
}		
}		
if(arraysizeYFlag){		
if(extendArraySizeFlag){		
arraysizeY	16	uimsbf
}		
else {		
arraysizeY	8	uimsbf
}		
}		
if(gapXFlag){		
gapX	32	fsbf
}		
if(gapYFlag){		
gapY	32	fsbf
}		

TactileCapabilityType {	Number of bits	Mnemonic
if(gapUnitFlag){		
gapUnit	8	bslbf
}		
if(maxUpdateRateFlag){		
maxUpdateRate	16	uimsbf
}		
if(updateRateUnitFlag){		
updateRateUnit	8	bslbf
}		
if(actuatorTypeFlag){		
actuatorType	3	blsbf
}		
if(numOfLevelsFlag){		
numOfLevels	16	uimsbf
}		
}		

5.13.4 Semantics

Semantics of the `TactileCapabilityType`.

Name	Definition
`TactileCapabilityType`	Tool for describing a tactile device capability.
`intensityUnitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxValueFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`minValueFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
arraysizeXFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
arraysizeYFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
gapXFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
gapYFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
gapUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxUpdateRateFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
updateRateUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
actuatorTypeFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfLevelsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
extendArraySizeFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
intensityUnit	Specifies the unit of the intensity for maxValue and minValue, as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. 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.

Name	Definition
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)
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 ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.
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 ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.
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 ISO/IEC 15938-5:2003, 7.6. A CS that may be used for this purpose is the TactileDisplayCS defined in ISO/IEC 23005-6: —, A.2.11.
numOfLevels	Describes the number of intensity levels that a tactile device can drive.

5.13.5 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: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"/>
```

5.14 Kinesthetic capability type

5.14.1 General

This subclause specifies syntax and semantics of capabilities of kinesthetic devices.

5.14.2 XML representation syntax

```
<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>
```

5.14.3 Binary representation syntax

KinestheticCapabilityType {	Number of bits	Mnemonic
MaximumTorqueFlag	1	bslbf
MaximumStiffnessFlag	1	bslbf
forceUnitFlag	1	bslbf
torqueUnitFlag	1	bslbf
stiffnessUnitFlag	1	bslbf
numOfForceLevelsFlag	1	bslbf
numOfTorqueLevelsFlag	1	bslbf
numOfStiffnessLevelsFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
MaximumForce		Float3DVectorType
if(MaximumTorqueFlag){		
MaximumTorque		Float3DVectorType
}		
if(MaximumStiffnessFlag){		
MaximumStiffness		Float3DVectorType
}		
DOF		DOFType
Workspace		WorkspaceType
if(forceUnitFlag) {		

KinestheticCapabilityType {	Number of bits	Mnemonic
forceUnit	8	bslbf
}		
if(torqueUnitFlag) {		
torqueUnit	8	bslbf
}		
if(stiffnessUnitFlag) {		
stiffnessUnit	8	bslbf
}		
if(numOfForceLevelsFlag) {		
numOfForceLevels	16	uimsbf
}		
if(numOfTorqueLevelsFlag) {		
numOfTorqueLevels	16	uimsbf
}		
if(numOfStiffnessLevelsFlag) {		
numOfStiffnessLevels	16	uimsbf
}		
}		
Float3DVectorType {		
X	32	fsbf
Y	32	fsbf
Z	32	fsbf
}		
DOFType {		
Tx	1	bslbf
Ty	1	bslbf

KinestheticCapabilityType {	Number of bits	Mnemonic
Tz	1	bslbf
Rx	1	bslbf
Ry	1	bslbf
Rz	1	bslbf
}		
WorkspaceType{		
Width	32	fsbf
Height	32	fsbf
Depth	32	fsbf
RotationX	32	fsbf
RotationY	32	fsbf
RotationZ	32	fsbf
}		

5.14.4 Semantics

Semantics of the `KinestheticCapabilityType`.

Name	Definition
`KinestheticCapability Type`	Tool for describing a kinesthetic device capability.
`MaximumTorqueFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`MaximumStiffnessFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`forceUnitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`torqueUnitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
stiffnessUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfForceLevelsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfTorqueLevelsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfStiffnessLevelsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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 ISO/IEC 23005-6: —, A.2.1, if any unit other than N(Newton) is used. 1N refers a force that produces an acceleration of 1 m/s² for 1 kg mass. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
torqueUnit	Specifies the unit of the description of maximumTorque attribute as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1, if any unit other than Nmm (Newton-millimetre) is used. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
stiffnessUnit	Specifies the unit of the description of maximumTorque attribute as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1, if any unit other than N/mm (Newton per millimetre) is used. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.

Name	Definition
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	Boolean values whether a kinesthetic device allows X directional independent translation or not.
Ty	Boolean values whether a kinesthetic device allows Y directional independent translation or not.
Tz	Boolean values whether a kinesthetic device allows Z directional independent translation or not.
Rx	Boolean values whether a kinesthetic device allows X directional independent rotation or not.
Ry	Boolean values whether a kinesthetic device allows Y directional independent rotation or not.
Rz	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 (millimetre) and three rotational values (roll, pitch and yaw) in degree are defined.
Width	Defines a maximum range in the unit of mm (millimetre) that a kinesthetic device can translate in X-axis.
Height	Defines a maximum range in the unit of mm (millimetre) that a kinesthetic device can translate in Y-axis.
Depth	Defines a maximum range in the unit of mm (millimetre) that a kinesthetic device can translate in Z-axis.

Name	Definition
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).

5.14.5 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 (3.3 N, 2.1 N, 2.7 N), and maximum stiffness, K (1.45 N/mm, 2.5 N/mm, 1.07 N/mm), and its workspace is 180 mm (width), 130 mm (height), and 80 mm (depth).

```
<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>
```

5.15 RigidBodyMotion capability type

5.15.1 General

This subclause specifies syntax and semantics of capabilities of motion generating devices.

5.15.2 XML representation syntax

```
<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>

<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>

<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>
```


5.15.3 Binary representation syntax

RigidBodyMotionCapabilityType {	Number of bits	Mnemonic
MoveTowardCapabilityFlag	1	bslbf
InclineCapabilityFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(MoveTowardCapabilityFlag){		
MoveTowardCapability		MoveTowardCapabilityType

RigidBodyMotionCapabilityType {	**Number of bits**	**Mnemonic**
}		
if(InclineCapabilityFlag){		
InclineCapability		InclineCapabilityType
}		
}		
MoveTowardCapabilityType {		
maxXDistanceFlag	1	bslbf
maxYDistanceFlag	1	bslbf
maxZDistanceFlag	1	bslbf
distanceUnitFlag	1	bslbf
maxXSpeedFlag	1	bslbf
maxYSpeedFlag	1	bslbf
maxZSpeedFlag	1	bslbf
speedUnitFlag	1	bslbf
maxXAccelFlag	1	bslbf
maxYAccelFlag	1	bslbf
maxZAccelFlag	1	bslbf
accelUnitFlag	1	bslbf
xDistanceLevelsFlag	1	bslbf
yDistanceLevelsFlag	1	bslbf
zDistanceLevelsFlag	1	bslbf
xSpeedLevelsFlag	1	bslbf
ySpeedLevelsFlag	1	bslbf
zSpeedLevelsFlag	1	bslbf
xAccelLevelsFlag	1	bslbf
yAccelLevelsFlag	1	bslbf

RigidBodyMotionCapabilityType {	Number of bits	Mnemonic
zAccelLevelsFlag	1	bslbf
if(maxXDistanceFlag){		
maxXDistance	32	fsbf
}		
if(maxYDistanceFlag){		
maxYDistance	32	fsbf
}		
if(maxZDistanceFlag){		
maxZDistance	32	fsbf
}		
if(distanceUnitFlag){		
distanceUnit	8	bslbf
}		
if(maxXSpeedFlag){		
maxXSpeed	32	fsbf
}		
if(maxYSpeedFlag){		
maxYSpeed	32	fsbf
}		
if(maxZSpeedFlag){		
maxZSpeed	32	fsbf
}		
if(speedUnitFlag){		
speedUnit	8	bslbf
}		
if(maxXAccelFlag){		

RigidBodyMotionCapabilityType {	Number of bits	Mnemonic
maxXAccel	32	fsbf
}		
if(maxYAccelFlag){		
maxYAccel	32	fsbf
}		
if(maxZAccelFlag){		
maxZAccel	32	fsbf
}		
if(accelUnitFlag){		
accelUnit	8	bslbf
}		
if(xDistanceLevelsFlag){		
xDistanceLevels	16	uimsbf
}		
if(yDistanceLevelsFlag){		
yDistanceLevels	16	uimsbf
}		
if(zDistanceLevelsFlag){		
zDistanceLevels	16	uimsbf
}		
if(xSpeedLevelsFlag){		
xSpeedLevels	16	uimsbf
}		
if(ySpeedLevelsFlag){		
ySpeedLevels	16	uimsbf
}		

RigidBodyMotionCapabilityType {	Number of bits	Mnemonic
if(zSpeedLevelsFlag){		
zSpeedLevels	16	uimsbf
}		
if(xAccelLevelsFlag){		
xAccelLevels	16	uimsbf
}		
if(yAccelLevelsFlag){		
yAccelLevels	16	uimsbf
}		
if(zAccelLevelsFlag){		
zAccelLevels	16	uimsbf
}		
}		
InclineCapabilityType {		
maxPitchAngleFlag	1	bslbf
maxYawAngleFlag	1	bslbf
maxRollAngleFlag	1	bslbf
maxPitchSpeedFlag	1	bslbf
maxYawSpeedFlag	1	bslbf
maxRollSpeedFlag	1	bslbf
speedUnitFlag	1	bslbf
maxPitchAccelFlag	1	bslbf
maxYawAccelFlag	1	bslbf
maxRollAccelFlag	1	bslbf
accelUnitFlag	1	bslbf
pitchAngleLevelsFlag	1	bslbf

RigidBodyMotionCapabilityType {	Number of bits	Mnemonic
yawAngleLevelsFlag	1	bslbf
rollAngleLevelsFlag	1	bslbf
pitchSpeedLevelsFlag	1	bslbf
yawSpeedLevelsFlag	1	bslbf
rollSpeedLevelsFlag	1	bslbf
pitchAccelLevelsFlag	1	bslbf
yawAccelLevelsFlag	1	bslbf
rollAccelLevelsFlag	1	bslbf
if(maxPitchAngleFlag){		
maxPitchAngle		InclineAngleType
}		
if(maxYawAngleFlag){		
maxYawAngle		InclineAngleType
}		
if(maxRollAngleFlag){		
maxRollAngle		InclineAngleType
}		
if(maxPitchSpeedFlag){		
maxPitchSpeed	32	fsbf
}		
if(maxYawSpeedFlag){		
maxYawSpeed	32	fsbf
}		
if(maxRollSpeedFlag){		
maxRollSpeed	32	fsbf
}		

RigidBodyMotionCapabilityType {	Number of bits	Mnemonic
if(speedUnitFlag){		
speedUnit	8	bslbf
}		
if(maxPitchAccelFlag){		
maxPitchAccel	32	fsbf
}		
if(maxYawAccelFlag){		
maxYawAccel	32	fsbf
}		
if(maxRollAccelFlag){		
maxRollAccel	32	fsbf
}		
if(accelUnitFlag){		
accelUnit	8	bslbf
}		
if(pitchAngleLevelsFlag){		
pitchAngleLevels	16	uimsbf
}		
if(yawAngleLevelsFlag){		
yawAngleLevels	16	uimsbf
}		
if(rollAngleLevelsFlag){		
rollAngleLevels	16	uimsbf
}		
if(pitchSpeedLevelsFlag){		
pitchSpeedLevels	16	uimsbf

RigidBodyMotionCapabilityType {	Number of bits	Mnemonic
}		
if(yawSpeedLevelsFlag){		
yawSpeedLevels	16	uimsbf
}		
if(rollSpeedLevelsFlag){		
rollSpeedLevels	16	uimsbf
}		
if(pitchAccelLevelsFlag){		
pitchAccelLevels	16	uimsbf
}		
if(yawAccelLevelsFlag){		
yawAccelLevels	16	uimsbf
}		
if(rollAccelLevelsFlag){		
rollAccelLevels	16	uimsbf
}		
}		

5.15.4 Semantics

Semantics of the `RigidBodyMotionCapabilityType` type.

Name	Definition
`RigidBodyMotionCapabilityType`	Tool for describing the capability of Rigid body motion effect.
`MoveTowardCapabilityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`InclineCapabilityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute

Name	Definition
	shall not be used.
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.
maxXDistanceFlag	This field, which is only present in the binary representation, signals the presence of the maxXDistance attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxYDistanceFlag	This field, which is only present in the binary representation, signals the presence of the maxYDistance attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxZDistanceFlag	This field, which is only present in the binary representation, signals the presence of the maxZDistance attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
distanceUnitFlag	This field, which is only present in the binary representation, signals the presence of the distanceUnit attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxXSpeedFlag	This field, which is only present in the binary representation, signals the presence of the maxXSpeed attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxYSpeedFlag	This field, which is only present in the binary representation, signals the presence of the maxYSpeed attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxZSpeedFlag	This field, which is only present in the binary representation, signals the presence of the maxZSpeed attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
speedUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxXAccelFlag	This field, which is only present in the binary representation, signals the presence of the maxXAccel attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
maxYAccelFlag	This field, which is only present in the binary representation, signals the presence of the maxYAccel attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxZAccelFlag	This field, which is only present in the binary representation, signals the presence of the maxZAccel attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
accelUnitFlag	This field, which is only present in the binary representation, signals the presence of the accelUnit attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
xDistanceLevelsFlag	This field, which is only present in the binary representation, signals the presence of the xDistanceLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
yDistanceLevelsFlag	This field, which is only present in the binary representation, signals the presence of the yDistanceLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
zDistanceLevelsFlag	This field, which is only present in the binary representation, signals the presence of the zDistanceLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
xSpeedLevelsFlag	This field, which is only present in the binary representation, signals the presence of the xSpeedLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
ySpeedLevelsFlag	This field, which is only present in the binary representation, signals the presence of the ySpeedLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
zSpeedLevelsFlag	This field, which is only present in the binary representation, signals the presence of the zSpeedLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
xAccelLevelsFlag	This field, which is only present in the binary representation, signals the presence of the xAccelLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
yAccelLevelsFlag	This field, which is only present in the binary representation, signals the presence of the yAccelLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
zAccelLevelsFlag	This field, which is only present in the binary representation, signals the presence of the zAccelLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
maxXDistance	Describes the maximum distance on X-axis that the device can provide in terms of centimetre. EXAMPLE The value ”10” means the device can move maximum 10 cm on X-axis. NOTE The value 0 means the device cannot provide X-axis movement.
maxYDistance	Describes the maximum distance on Y-axis that the device can provide in terms of centimetre.
maxZDistance	Describes the maximum distance on Z-axis that the device can provide in terms of centimetre.
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 ISO/IEC 23005-6: —, A.2.1, if any unit other than cm (centimetre) 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 ISO/IEC 15938-5:2003, 7.6.
maxXSpeed	Describes the maximum speed on X-axis that the device can provide in terms of centimetre per second.
maxYSpeed	Describes the maximum speed on Y-axis that the device can provide in terms of centimetre per second.
maxZSpeed	Describes the maximum speed on Z-axis that the device can provide in terms of centimetre 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 ISO/IEC 23005-6: —, A.2.1, if any unit other than cm/sec (centimetre 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 ISO/IEC 15938-5:2003, 7.6.
maxXAccel	Describes the maximum acceleration on X-axis that the device can provide in terms of centimetre per square second.
maxYAccel	Describes the maximum acceleration on Y-axis that the device can provide in terms of centimetre per square second.
maxZAccel	Describes the maximum acceleration on Z-axis that the device can provide in terms of centimetre per second square.

Name	Definition
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 ISO/IEC 23005-6: —, A.2.1, if any unit other than cm/sec² (centimetre 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 ISO/IEC 15938-5:2003, 7.6.
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.
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.
maxPitchAngleFlag	This field, which is only present in the binary representation, signals the presence of the maxPitchAngle attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
maxYawAngleFlag	This field, which is only present in the binary representation, signals the presence of the maxYawAngle attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxRollAngleFlag	This field, which is only present in the binary representation, signals the presence of the maxRollAngle attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxPitchSpeedFlag	This field, which is only present in the binary representation, signals the presence of the maxPitchSpeed attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxYawSpeedFlag	This field, which is only present in the binary representation, signals the presence of the maxYawSpeed attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxRollSpeedFlag	This field, which is only present in the binary representation, signals the presence of the maxRollSpeed attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
speedUnitFlag	This field, which is only present in the binary representation, signals the presence of the speedUnit attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxPitchAccelFlag	This field, which is only present in the binary representation, signals the presence of the maxPitchAccel attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxYawAccelFlag	This field, which is only present in the binary representation, signals the presence of the maxYawAccel attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxRollAccelFlag	This field, which is only present in the binary representation, signals the presence of the maxRollAccel attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
accelUnitFlag	This field, which is only present in the binary representation, signals the presence of the accelUnit attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
pitchAngleLevelsFlag	This field, which is only present in the binary representation, signals the presence of the pitchAngleLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
yawAngleLevelsFlag	This field, which is only present in the binary representation, signals the presence of the yawAngleLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
rollAngleLevelsFlag	This field, which is only present in the binary representation, signals the presence of the rollAngleLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
pitchSpeedLevelsFlag	This field, which is only present in the binary representation, signals the presence of the pitchSpeedLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
yawSpeedLevelsFlag	This field, which is only present in the binary representation, signals the presence of the yawSpeedLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
rollSpeedLevelsFlag	This field, which is only present in the binary representation, signals the presence of the rollSpeedLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
pitchAccelLevelsFlag	This field, which is only present in the binary representation, signals the presence of the pitchAccelLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
yawAccelLevelsFlag	This field, which is only present in the binary representation, signals the presence of the yawAccelLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
rollAccelLevelsFlag	This field, which is only present in the binary representation, signals the presence of the rollAccelLevels attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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.

Name	Definition
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 ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.
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 ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.
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.

Name	Definition
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.

5.15.5 Examples

This example shows the description of a RigidbodyMotion capability. This device can move maximum 20 cm on X and Y-axis. The maximum moving speed of example device on X-axis, Y-axis is 10 cm/sec and Z-axis is 0. Also the maximum acceleration on X-axis, Y-axis is 1 cm/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. This device can also rotate 180 degrees and 90 degrees on X- and Y-axis. The maximum rotation speed of example device on X-axis, Y-axis is 10 degree/sec and Z-axis is 0. Also the maximum acceleration on X-axis, Y-axis is 2 degree/sec^2 and Z-axis is 0. That is, example device can not rotate on Z-axis. X speed level and acceleration level is “1”, Y speed level and acceleration level is “1” respectively.

```
<cidl:SensoryDeviceCapability
xsi:type="dcdv:RigidBodyMotionCapabilityType">
<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"
distanceUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:cm"
speedUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:cmpersec"
accelUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:cmpersecsquared"/>
<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" speedUnit="urn:mpeg:mpeg-v:01-CI-
UnitTypeCS-NS:degpersec" accelUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-
NS:degpersecsquared"/>
</cidl:SensoryDeviceCapability>
```

5.16 Mobile device position capability type

5.16.1 General

This subclause specifies syntax and semantics of capability description including the description of the region within which a moving device can navigate.

5.16.2 XML representation syntax

```
<complexType name="MobileDevicePositionCapabilityType">
   <complexContent>
      <extension base="cidl:SensoryDeviceCapabilityBaseType">
         <sequence>
            <element name="Boundary"
type="dcdv:PhysicalSpaceBoundingBoxType"/>
         </sequence>
<!-- Precision -->
         <attribute name="numOfLongitudeLevels" type="nonNegativeInteger"
use="optional"/>
         <attribute name="numOfLatitudeLevels" type="nonNegativeInteger"
use="optional"/>
         <attribute name="numOfAltitudeLevels" type="nonNegativeInteger"
use="optional"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="PhysicalSpaceBoundingBoxType">
   <sequence>
      <element name="Longitude">
         <complexType>
            <attribute name="lowerBound" use="optional" default="-180.0">
               <simpleType>
                  <restriction base="double">
                     <minInclusive value="-180.0"/>
                     <maxInclusive value="180.0"/>
                  </restriction>
               </simpleType>
            </attribute>
            <attribute name="upperBound" use="optional" default="180.0">
               <simpleType>
                  <restriction base="double">
                     <minInclusive value="-180.0"/>
                     <maxInclusive value="180.0"/>
                  </restriction>
               </simpleType>
            </attribute>
         </complexType>
      </element>
      <element name="Latitude">
         <complexType>
            <attribute name="lowerBound" use="optional" default="-90.0">
               <simpleType>
                  <restriction base="double">
                     <minInclusive value="-90.0"/>
                     <maxInclusive value="90.0"/>
                  </restriction>
               </simpleType>
            </attribute>
            <attribute name="upperBound" use="optional" default="90.0">
               <simpleType>
                  <restriction base="double">
```

```
                    <minInclusive value="-90.0"/>
                    <maxInclusive value="90.0"/>
                 </restriction>
              </simpleType>
           </attribute>
        </complexType>
     </element>
     <element name="Altitude">
        <complexType>
           <attribute name="lowerBound" type="double" use="optional"
default="0.0"/>
           <attribute name="upperBound" type="double" use="optional"/>
           <attribute name="unit" type="mpegvct:unitType"
use="optional"/>
        </complexType>
     </element>
  </sequence>
</complexType>
```

5.16.3 Binary representation syntax

MobileDevicePositionCapabilityType {	**Number of bits**	**Mnemonic**
numOfLongitudeLevelsFlag	**1**	**bsblf**
numOfLatitudeLevelsFlag	**1**	**bsblf**
numOfAltitudeLevelsFlag	**1**	**bsblf**
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
Boundary		PhysicalSpaceBoundingBoxType
if(numOfLongitudeLevelsFlag){		
numOfLongitudeLevels	32	uimsbf
}		
if(numOfLatitudeLevelsFlag){		
numOfLatitudeLevels	32	uimsbf
}		
if(numOfAltitudeLevelsFlag){		
numOfAltitudeLevels	32	uimsbf
}		
}		
PhysicalSpaceBoundingBoxType {		

MobileDevicePositionCapabilityType {	Number of bits	Mnemonic
longitudeUpperBoundFlag	1	bsblf
longitudeLowerBoundFlag	1	bsblf
latitudeUpperBoundFlag	1	bsblf
latitudeLowerBoundFlag	1	bsblf
altitudeUpperBoundFlag	1	bsblf
altitudeLowerBoundFlag	1	bsblf
altitudeUnitFlag	1	bsblf
if(longitudeUpperBoundFlag) {		
longitudeUpperBound	32	fsfb
}		
if(longitudeLowerBoundFlag) {		
longitudeLowerBound	32	fsfb
}		
if(latitudeUpperBoundFlag) {		
latitudeUpperBound	32	fsfb
}		
if(latitudeLowerBoundFlag) {		
latitudeLowerBound	32	fsfb
}		
if(altitudeUpperBoundFlag) {		
altitudeUpperBound	32	fsfb
}		
if(altitudeLowerBoundFlag) {		
altitudeLowerBound	32	fsfb
}		
if(altitudeUnitFlag) {		

MobileDevicePositionCapabilityType {	Number of bits	Mnemonic
altitudeUnit	8	bslbf
}		
}		

5.16.4 Semantics

Semantics of the `MobileDevicePositionCapabilityType`.

Names	Description
`MobileDevicePositionCapabilityType`	Tool for describing capabilities of a mobile device which can move to a destination given as a position in the global positioning system, i.e. in longitude, latitude, and altitude above sea level.
`zerothOrderDelayTime`	Describes required preparation time of the mobile device to be activated since it receives a command in the unit of millisecond (ms).
`firstOrderDelayTime`	Describes the delay time for a mobile device to reach the crusing speed since it receives a command and is activated in the unit of millisecond (ms).
`location`	Does not have any specific semantics in this description.
`Boundary`	Describes the destination position where the mobile device can reach in forms of three-dimensional bounding box, specified by using `PhysicalSpaceBoundingBoxType`.
`numOfLongitudeLevelsFlag`	This field, which is only present in the binary representation, indicates if the optional attribute of `numOfLongitudeLevels` is present in this instance of the description.
`numOfLongitudeLevels`	Describes the number of longitude levels that the device can provide in between upper bound and lower bound longitude positions.
`numOfLatitudeLevelsFlag`	This field, which is only present in the binary representation, indicates if the optional attribute of `numOfLatitudeLevels` is present in this instance of the description.
`numOfLatitudeLevels`	Describes the number of latitude levels that the device can provide in between upper bound and lower bound latitude positions.
`numOfAltitudeLevelsFlag`	This field, which is only present in the binary representation, indicates if the optional attribute of `numOfAltitudeLevels` is present in this instance of the description.

Names	Description
numOfAltitudeLevels	Describes the number of altitude levels that the device can provide in between upper bound and lower bound altitude positions.
unit	Does not have any specific semantics in this description.
longitudeUpperBoundFlag	This field, which is only present in the binary representation, indicates if the optional attribute of upperBound of Longitude element is present in this instance of the description.
longitudeLowerBoundFlag	This field, which is only present in the binary representation, indicates if the optional attribute of lowerBound of Longitude element is present in this instance of the description.
latitudeUpperBoundFlag	This field, which is only present in the binary representation, indicates if the optional attribute of upperBound of Latitude element is present in this instance of the description.
latitudeLowerBoundFlag	This field, which is only present in the binary representation, indicates if the optional attribute of lowerBound of Latitude element is present in this instance of the description.
altitudeUpperBoundFlag	This field, which is only present in the binary representation, indicates if the optional attribute of upperBound of Altitude element is present in this instance of the description.
altitudeLowerBoundFlag	This field, which is only present in the binary representation, indicates if the optional attribute of lowerBound of Altitude element is present in this instance of the description.
altitudeUnitFlag	This field, which is only present in the binary representation, indicates if the optional attribute of unit of Altitude element is present in this instance of the description.
PhysicalSpaceBoundingBoxType	Describes a bounding box in a physical space using longitude, latitude, and altitude.
Longitude	Describes lower bound and upper bound of longitude for the bounding box that the mobile device can reach.
lowerBound	Lower bound of longitude given in degrees. Positive number represents eastern longitude and the negative number represents western longitude.
upperBound	Upper bound of longitude given in degrees. Positive number represents eastern longitude and the negative number represents western longitude.
Latitude	Describes lower bound and upper bound of latitude for the bounding box that the mobile device can reach.

Names	Description
lowerBound	Lower bound of latitude given in degrees. Positive number represents nothern latitude and the negative number represents southern latitude.
upperBound	Upper bound of latitude given in degrees. Positive number represents nothern latitude and the negative number represents southern latitude.
Altitude	Describes lower bound and upper bound of altitude for the bounding box that the mobile device can reach.
lowerBound	Lower bound of altitude above sea level given in metres. The default is zero.
upperBound	Upper bound of altitude above sea level given in metres.
unit	Specifies the unit of the lowerBound and upperBound of Altitude, if a unit other than the metre is used, as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1.

5.16.5 Examples

The following example shows the capability description of a mobile device with id "mobile1", which can move from 127 degrees East to 132 degrees East in longitude, from 32 degrees North to 45 degrees North in latitude, and from 10 metres to 1 200 metres above sea level.

```
<cidl:SensoryDeviceCapability
xsi:type="dcdv:MobileDevicePositionCapabilityType" id="mobile1">
   <dcdv:Boundary>
      <dcdv:Longitude upperBound="132" lowerBound="127"/>
      <dcdv:Latitude upperBound="45" lowerBound="32"/>
      <dcdv:Altitude           upperBound="1200"           lowerBound="10"
unit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:meter"/>
   </dcdv:Boundary>
</cidl:SensoryDeviceCapability>
```

5.17 Bubble capability type

5.17.1 General

This subclause specifies syntax and semantics of capabilities of bubble generating devices.

5.17.2 XML representation syntax

```
<complexType name="BubbleCapabilityType">
  <complexContent>
  <extension base="cidl:SensoryDeviceCapabilityBaseType">
  <attribute name="flag" type="boolean" use="optional" default="false"/>
    </extension>
  </complexContent>
```

```
</complexType>
```

5.17.3 Binary representation syntax

BubbleCapabilityType {	Number of Bits	Mnemonic
flagFlag	1	bslbf
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
if(flagFlag) {		
flag	1	bslbf
}		
}		

5.17.4 Semantics

Semantics of the `BubbleCapabilityType`.

Name	Definition
`BubbleCapabilityType`	Tool for describing if the given device has a bubble capability.
`flagFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`flag`	Describes the existence of the bubble capability of the given device in terms of "true" and "false".

5.17.5 Examples

This example shows the description of a bubble capability with the following semantics. Since the Flag is "true", the device "bubble1" is equipped with a capability of bubble effect.

```
<cidl:SensoryDeviceCapability xsi:type="dcdv:BubbleCapabilityType"
flag="true" id="bubble1"/>
```

5.18 3D Printing capability type

5.18.1 General

This subclause specifies XML syntax, and semantics of the `ThreeDPrinterCapabilityType` with an example instantiation of the device capability. This type is intended to express capability of a 3D printer with materials available to characterize the printer.

5.18.2 XML representation syntax

```
<!-- ================================================ -->
```

```
<!-- ================ ThreeD Printing Device ========= -->
<!-- ================================================= -->
<complexType name="ThreeDPrintingCapabilityType">
  <complexContent>
    <extension base="cidl:SensoryDeviceCapabilityBaseType">
      <sequence>
        <element name="GeneralDescription" minOccurs="0">
          <complexType>
            <attribute name="printingTechnologyType"
type="mpeg7:termReferenceType" use="required"/>
      <attribute name="printerManufacturer" type="string"
use="optional"/>
      <attribute name="printerBrand" type="string" use="optional"/>
      <attribute name="printerModel" type="string" use="optional"/>
      <attribute name="numPrinterHead" type="integer" use="optional"
default="1"/>
      <attribute name="printSpeed" type="float" use="optional"/>
      <attribute name="speedUnit" type="mpeg7:termReferenceType"
use="optional"/>
      <!-- default unit: mm/sec -->
      <attribute name="nozzleSize" type="float" use="optional"/>
      <attribute name="nozzleSizeUnit" type="mpeg7:termReferenceType"
use="optional"/>
      <!-- default unit: mm -->
          </complexType>
        </element>
        <element name="SupportedPrintingMaterial"
type="dcdv:ThreeDPrintingMaterialType" minOccurs="1"
maxOccurs="unbounded"/>
        <element name="SupportedColor" type="dcdv:SupportedColorType"
minOccurs="0" maxOccurs="unbounded"/>
        <choice>
           <element name="ThreeDPrintingXYZLUT"
type="mpeg7:DoubleMatrixType"/>
           <element name="ThreeDPrintingSpectrumLUT"
type="mpeg7:DoubleMatrixType"/>
       </choice>
       <element name="MaximumPrintSize" minOccurs="0">
          <complexType>
            <attribute name="maxWidth" type="float" use="optional"/>
      <attribute name="maxDepth" type="float" use="optional"/>
      <attribute name="maxHeight" type="float" use="optional"/>
      <attribute name="unit" type="mpeg7:termReferenceType"
use="optional"/>
      <!-- default unit: mm -->
          </complexType>
        </element>
     <element name="PrinterResolution" minOccurs="0">
       <complexType>
      <attribute name="xResolution" type="float" use="optional"/>
      <attribute name="xResolutionUnit" type="mpeg7:termReferenceType"
use="optional"/>
      <attribute name="yResolution" type="float" use="optional"/>
      <attribute name="yResolutionUnit" type="mpeg7:termReferenceType"
use="optional"/>
```

```
      <attribute name="zResolution" type="float" use="optional"/>
      <attribute name="zResolutionUnit" type="mpeg7:termReferenceType"
use="optional"/>
      <!-- default unit: dpi -->
      <!-- default unit: mm -->
       </complexType>
     </element>
     <element name="Accuracy" minOccurs="0">
       <complexType>
      <simpleContent>
        <extension base="float">
          <attribute name="accuracyUnit" type="mpeg7:termReferenceType"
use="optional"/>
        </extension>
        <!-- default unit: mm -->
      </simpleContent>
       </complexType>
     </element>
     <element name="ServiceRelatedCapabilities" minOccurs="0">
       <complexType>
      <sequence>
        <element name="SupportedFileType" type="mpeg7:termReferenceType"
minOccurs="0" maxOccurs="unbounded"/>
        <element name="FastestDelivery" minOccurs="0">
          <complexType>
         <simpleContent>
           <extension base="integer">
             <attribute name="timeUnit">
            <simpleType>
              <restriction base="string">
                <enumeration value="day"/>
                <enumeration value="hour"/>
              </restriction>
            </simpleType>
             </attribute>
           </extension>
         </simpleContent>
          </complexType>
        </element>
      </sequence>
       </complexType>
     </element>
   </sequence>
    </extension>
  </complexContent>
</complexType>

<complexType name="ThreeDPrintingMaterialType">
  <sequence>
    <choice>
      <element name="SingleMaterial" type="dcdv:SingleMaterialType"/>
      <element name="CompositeMaterials"
type="dcdv:CompositeMaterialsType"/>
    </choice>
  </sequence>
```

```
</complexType>

<complexType name="SingleMaterialType">
  <sequence>
    <element name="Color" type="mpegvct:colorType" minOccurs="0"
maxOccurs="unbounded"/>
  </sequence>
  <attribute name="minThermalOperatingRange" type="float" use="optional"/>
  <attribute name="maxThermalOperatingRange" type="float" use="optional"/>
  <attribute name="thermalOperatingRangeUnit"
type="mpeg7:termReferenceType" use="optional"/>
  <attribute name="transparencyLevel" type="float" use="optional"/>
  <attribute name="transparencyUnit" type="mpeg7:termReferenceType"
use="optional"/>
  <attribute name="printingMaterialClass" type="mpeg7:termReferenceType"
use="optional"/>
  <attribute name="printingMaterialProvider" type="string"
use="optional"/>
  <attribute name="printingMaterialName" type="string" use="optional"/>
  <attribute name="Description" type="string" use="optional"/>
</complexType>

<complexType name="CompositeMaterialsType">
  <sequence>
    <element name="ComponentMaterial" maxOccurs="unbounded">
      <complexType>
    <complexContent>
     <extension base="dcdv:SingleMaterialType">
      <attribute name="CompositeRatio" type="float" use="optional"
default="1"/>
     </extension>
    </complexContent>
      </complexType>
    </element>
  </sequence>
</complexType>

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

<complexType name="MonochromeColorType">
  <complexContent>
    <extension base="dcdv:SupportedColorType">
    <attribute name="color" type="mpegvct:colorType"/>
    </extension>
  </complexContent>
</complexType>
<complexType name="MultiColorType">
  <complexContent>
    <extension base="dcdv:SupportedColorType">
    <sequence>
      <element name="ColorEntry" type="mpegvct:colorType"
maxOccurs="unbounded"/>
    </sequence>
    </extension>
  </complexContent>
```

```
</complexType>
<complexType name="NaturalColorType">
  <complexContent>
    <extension base="dcdv:SupportedColorType">
   <attribute name="colorDepth" type="integer"/>
    </extension>
  </complexContent>
</complexType>
```

5.18.3 Binary representation syntax

ThreeDPrintingCapabilityType {	Number of bits	Mnemonic
GeneralDescriptionFlag	1	bslbf
MaximumPrintSizeFlag	1	bslbf
PrinterResolutionFlag	1	bslbf
AccuracyFlag	1	bslbf
ServiceRelatedCapabilitiesFlag	1	bslbf
SupportedPrintingMaterialCount	32	uimsbf
SupportedColorCount	32	uimsbf
SensoryDeviceCapabilityBaseType		SensoryDeviceCapabilityBaseType
if(GeneralDescriptionFlag) {		
printerManufacturerFlag	1	bslbf
printerBrandFlag	1	bslbf
printerModelFlag	1	bslbf
numPrinterHeadFlag	1	bslbf
printSpeedFlag	1	bslbf
speedUnitFlag	1	bslbf
nozzleSizeFlag	1	bslbf
nozzleSizeUnitFlag	1	bslbf
PrintingTechnologyType	5	3DPrinterTypeCS
if(printerManufacturerFlag) {		
printerManufacturerLength		vluimsbf5

ThreeDPrintingCapabilityType {	**Number of bits**	**Mnemonic**
printerManufacturer	See ISO/IEC 10646[4]	UTF-8
}		
if(printerBrandFlag) {		
printerBrandLength		vluimsbf5
printerBrand	See ISO/IEC 10646[4]	UTF-8
}		
if(printerModelFlag) {		
printerModelLength		vluimsbf5
printerModel	See ISO/IEC 10646[4]	UTF-8
}		
if(numPrinterHeadFlag) {		
numPrinterHead	32	uimsbf
}		
if(printSpeedFlag) {		
printSpeed	32	flbf
}		
if(speedUnitFlag) {		
speedUnit	8	bslbf
}		
if(nozzleSizeFlag) {		
nozzleSize	32	flbf
}		
if(nozzleSizeUnitFlag) {		
nozzleSizeUnit	8	bslbf

ThreeDPrintingCapabilityType {	Number of bits	Mnemonic
}		
}		
for(i=0;i<SupportedPrintingMaterialCount;i++) {		
SupportedPrintingMaterial[i]		ThreeDPrintingMaterialType
}		
for(i=0;i<SupportedColorCount;i++) {		
SupportedColor[i]		SupportedColorType
}		
IsSpectrumLUTFlag	1	bslbf
if(IsSpectrumLUTFlag){		
SpectrumLUTWidth	8	uimsbf
SpectrumLUTHeight	8	uimsbf
SpectrumDimension	8	uimsbf
for(i=0;i<SpectrumLUTHeight;i++) {		
for(k=0;k<SpectrumLUTWidth;k++) {		
ThreeDPrintingSpectrumLUT[i][k]	32	fsfb
}		
}		
} else {		
XYZLUTwidth	8	uimsbf
XYZLUTheight	8	uimsbf
for(i=0;i<XYZLUTheight;i++) {		
for(k=0;k<XYZLUTwidth;k++) {		
ThreeDPrintingXYZLUT[i][k]	32	fsfb
}		

ThreeDPrintingCapabilityType {	Number of bits	Mnemonic
}		
}		
}		
if(MaximumPrintSizeFlag) {		
maxWidthFlag	1	bslbf
maxDepthFlag	1	bslbf
maxHeightFlag	1	bslbf
unitFlag	1	bslbf
if(maxWidthFlag) {		
maxWidth	32	flbf
}		
if(maxDepthFlag) {		
maxDepth	32	flbf
}		
if(maxHeightFlag) {		
maxHeight	32	flbf
}		
if(unitFlag) {		
Unit	8	bslbf
}		
}		
if(PrinterResolutionFlag) {		
xResolutionFlag	1	bslbf
xResolutionUnitFlag	1	bslbf
yResolutionFlag	1	bslbf
yResolutionUnitFlag	1	bslbf

ThreeDPrintingCapabilityType {	Number of bits	Mnemonic
zResolutionFlag	1	bslbf
zResolutionUnitFlag	1	bslbf
if(xResolutionFlag) {		
xResolution	32	flbf
}		
if(xResolutionUnitFlag) {		
xResolutionUnit	8	bslbf
}		
if(yResolutionFlag) {		
yResolution	32	flbf
}		
if(yResolutionUnitFlag) {		
yResolutionUnit	8	bslbf
}		
if(zResolutionFlag) {		
zResolution	32	flbf
}		
if(zResolutionUnitFlag) {		
zResolutionUnit	8	bslbf
}		
}		
if(AccuracyFlag) {		
AccuracyUnitFlag	1	bslbf
if(AccuracyUnitFlag) {		
AccuracyUnit	8	bslbf
}		

ThreeDPrintingCapabilityType {	Number of bits	Mnemonic
}		
if(ServiceRelatedCapabilitiesFlag) {		
FastestDeliveryFlag	1	bslbf
SupportedFileTypeCount	32	Uimsbf
for(i=0;i<SupportedFileTypeCount;i++) {		
SupportedFileType	4	3DPrinterFileFormatTypeCS
}		
if(FastestDeliveryFlag) {		
timeUnitLength		vluimsbf5
timeUnit	See ISO/IEC 10646[4]	UTF-8
FastestDelivery	32	Simbf
}		
}		
}		

ThreeDPrintingMaterialType {	Number of bits	Mnemonic
useSingleMaterialFlag	1	Bslbf
If (useSingleMaterialFlag) {		
SingleMaterial		SingleMaterialType
} Else {		
CompositeMaterials		CompositeMaterialsType
}		
}		
SingleMaterialType {		

minThermalOperatingRangeFlag	1	bslbf
maxThermalOperatingRangeFlag	1	bslbf
thermalOperatingRangeUnitFlag	1	bslbf
transparencyLevelFlag	1	bslbf
transparencyUnitFlag	1	bslbf
printingMaterialClassFlag	1	bslbf
printingMaterialProviderFlag	1	bslbf
printingMaterialNameFlag	1	bslbf
DescriptionFlag	1	bslbf
ColorCount	32	Uimsbf
for(i=0;i<ColorCount;i++) {		
Color		colorType
}		
If(DescriptionFlag)		
DescriptionLength		vluimsbf5
Description	See ISO/IEC 10646[4]	UTF-8
}		
if(minThermalOperatingRangeFlag) {		
minThermalOperatingRange	32	flbf
}		
if(maxThermalOperatingRangeFlag) {		
maxThermalOperatingRange	32	flbf
}		
if(thermalOperatingRangeUnitFlag) {		
thermalOperatingRangeUnit	8	bslbf
}		

if(transparencyLevelFlag) {		
transparencyLevel	32	flbf
}		
if(transparencyUnitFlag) {		
transparencyUnit	8	bslbf
}		
if(printingMaterialClassFlag) {		
printingMaterialClass	8	PringtingMaterialTypeCS
}		
if(printingMaterialProviderFlag) {		
printingMaterialProviderLength		vluimsbf5
printingMaterialProvider	See ISO/IEC 10646[4]	UTF-8
}		
if(printingMaterialNameFlag) {		
printingMaterialNameLength		vluimsbf5
printingMaterialName	See ISO/IEC 10646[4]	UTF-8
}		
CompositeMaterialsType {	**Number of bits**	**Mnemonic**
ComponentMaterialCount	32	Uimsbf
for (i=0;i< ComponentMaterialCount;i++) {		
CompositeRatioFlag	1	bslbf
SingleMaterialType		SingleMaterialType
If (CompositeRatioFlag) {		
CompositeRatio	32	flbf
}		

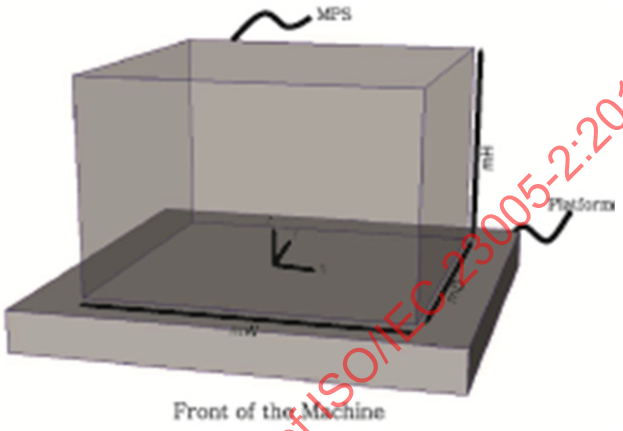
}		
}		
MonochromeColorType {	**Number of bits**	**Mnemonic**
Color		colorType
}		
MultiColorType {	**Number of bits**	**Mnemonic**
colorEntryCount	32	Uimsbf
for(i=0;i<colorEntryCount;i++) {		
colorEntry		colorType
}		
}		
NaturalColorType {	**Number of bits**	**Mnemonic**
colorDepth	32	Simsbf
}		

5.18.4 Semantics

Semantics of the `ThreeDPrintingCapabilityType`.

Name	Definition
`ThreeDPrintingCapabilityType`	Tool for describing the capability of a 3D printer
`GeneralDescription`	Specifies the general/common characteristics of a 3D printer
`printingTechonologyType`	Describe the type of the technology applied for the 3D printing. Some examples are FDM (Fused Deposition Modeling), EBF[3] (Electron Beam Freeform Fabrication), and DMLS (Direct Metal Laser Sintering). The printer types are defined in the classification scheme given at the end of the syntax.

Name	Definition
printerManufacturer	Specifies the name of the manufacturer of the printer
printerBrand	Specifies the brand name of the printer. In many cases, the brand name can be identical to the name of the manufacturer.
printerModel	Specifies the specific model name of the printer.
numPrinterHead	Describes the number of printer heads. If not specified, the default value is 1.
printSpeed	Specifies the average speed of printing. When it is not defined by the speedUnit attribute, the default unit of printing speed is mm/sec.
speedUnit	Specifies the unit used in specifying the print speed in printSpeed attribute, as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
nozzleSize	Describes the size of the nozzle used to print. When it is not defined by the nozzleSizeUnit attribute, the default unit of the nozzle size is mm.
nozzleSizeUnit	Specifies the unit of the nozzleSize, as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. If this attribute is not specified, the default unit of mm (millimetre) is used. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
SupportedPrintingMaterial	Specifies the material that can be used by this specific printer.
SupportedColor	Specifies the colour that this printer can use for printing.

Name	Definition
MaximumPrintSize	Describes the maximum size of the object that this printer can print. The maximum printing size and its coorditnate system are illustrated in Figure 4where *MPS* denotes the MaximumPrintSize, *mH* denotes the maxHeight, *mW* denotes the maxWidth, and *md* denotes the maxDepth.  **Figure 4 — Maximum printing size and the definition of X, Y, Z coordinate**
maxWidth	Specifies the maximum size of the printable object in the horizontal direction when the user is looking at the printer from the front of the device.
maxDepth	Specifies the maximum size of the printable object in the viewing direction when the user is looking at the printer from the front of the device.
maxHeight	Specifies the maximum size of the printable object in the vertical (upright) direction when the user is looking at the printer from the front of the device.
unit	Specifies the unit of the maxWdith, maxDepth, and maxHeight, as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. If this attribute is not specified, the default unit of mm (millimetre) is used. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
PrinterResolution	Specifies the resolution of the printer. This element specifies the printer resolution in X, Y, and Z direction.
xResolution	Specifies the resolution of the printer in X direction.

Name	Definition
xResolutionUnit	Specifies the unit of the X-directional resolution as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. If this attribute is not specified, the default unit of dpi (dots per inch) is used. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
yResolution	Specifies the resolution of the printer in Y direction.
yResolutionUnit	Specifies the unit of the Y-directional resolution as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. If this attribute is not specified, the default unit of dpi (dots per inch) is used. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
zResolution	Specifies the resolution of the printer in Z direction.
zResolutionUnit	Specifies the unit of the Z-directional resolution as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. If this attribute is not specified, the default unit of mm (millimetre) is used. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
Accuracy	Specifies the accuracy of the printer in floating number, i.e. provides the capability of the printer in terms of positional (spatial) errors in printing an object.
AccuracyUnit	Specifies the unit of the accuracy as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. If this attribute is not specified, the default unit of mm (millimetre) is used. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
ServiceRelatedCapabilities	Describes the capabilities related to service provided by the printer

Name	Definition
SupportedFileType	Specifies the file type that this printer can understand and print using as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. The CS that may be used for this purpose is the 3DPrinterFileFormatTypeCS defined in ISO/IEC 23005-6: —, A.2.17. The binary representation of the 3DPrinterFileFormatTypeCS is also defined in ISO/IEC 23005-6: —, A.2.17.
FastedDelivery	Describes the expected earliest time of delivery in terms of day or hour to be spent until the delivery of the printed object
ThreeDPrintingMaterialType	Specifies the characteristics of a printing material. This element may have SingleMaterial and CompositeMaterials as its subelements.
SingleMaterial	Specifies the characteristics of a single printing material. It's type is SingleMaterialType
CompositeMaterials	Specifies the characteristics of a composite printing material. Its type is CompositeMaterialType
SingleMaterialType	Specifies the characteristics of a single printing material. It has printingMaterialClass as attribute.
Color	Specifies the colour of the material.
IsSpectrumLUTFlag	This field, which is only present in the binary representation, signals the presence of the spectrum look-up-table. A value of "1" means the ThreeDPrintingSpectrumLUT element shall be used and "0" means the ThreeDPrintingXYZLUT element shall be used.
ThreeDPrintingXYZLUT	Describes a look-up table for the 3D printing colour reproduction. Each row of the table consists of 6 values, which are *R*, *G*, *B*, *X*, *Y*, and *Z* in the order named. *R*, *G*, and *B* represent the input RGB value, and X, Y, Z represent the corresponding output XYZ value.
ThreeDPrintingSpectrumLUT	Describes a look-up table for the 3D printing colour reproduction. *R*, *G*, and *B* represent the input RGB value, and 400 nm to 700 nm represent the corresponding output spectrum value.

Name	Definition
XYZLUTwidth	This field, which is only present in the binary representation, describes a width of the ThreeDPrintingLUT. This width is fixed with 6, which represent *R*, *G*, *B*, *X*, *Y*, and *Z* in the order named.
XYZLUTheight	This field, which is only present in the binary representation, describes a height of the ThreeDPrintingLUT. Each row contains RGB input values and its corresponding XYZ values. The height of the table may depend on the number of sample patches measured by a colorimeter or a spectrophotometer.
SpectrumLUTwidth	This field, which is only present in the binary representation, describes a width of the ThreeDPrintingSpectrumLUT. This width is summation of three plus SpectrumDimension, which represent *R*, *G*, *B*, *Spectrum values* in the order named. For example, when the SpectrumDimension is 31, the SpectrumLUTwidth becomes 34 where it is the summation of three (i.e., RGB) and SpectrumDimension.
SpectrumLUTheight	This field, which is only present in the binary representation, describes a height of the ThreeDPrintingSpectrumLUT. Each row contains RGB input values and its corresponding Spectrum values. The height of the table may depend on the number of sample patches measured by a colorimeter or a spectrophotometer.
SpectrumDimension	The maximum size of the spectrum dimension is 301 since this covers a visible spectrum range between 400 nm and 700 nm for every 1 nm. The spectrum dimension can be subsampled linearly. For example, if the sampling rate is every 10 *nm*, the spectrum dimension becomes 31.
minThermalOperatingRange	Specifies the minimum temperature of operation for the material.
maxThermalOperatingRange	Specifies the maximum temperature of operation for the material.

Name	Definition
thermalOperatingRangeUnit	Specifies the unit of the thermal operating range as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. If this attribute is not specified, the default unit of Celsius degree is used. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
transparency	Specifies the transparency of the materal.
transparencyUnit	Specifies the unit of the transparency as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. If this attribute is not specified, the default unit of % (percent) is used. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
printingMaterialClass	Describes the class of material by referencing to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. The CS that may be used for this purpose is the PrintingMaterialTypeCS defined in ISO/IEC 23005-6: —, A.2.19. The binary representation of the PrintingMaterialTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1. Examples of the material class can be ABS, Rubber, Aluminum Alloy, etc.
printingMaterialProvider	Describes the name of the material provider in string
printingMaterialName	Describes the exact name of the material as provided by the provider
Description	Describes the characteristics of the material.
CompositeMaterialsType	Describes the characteristics of a composite material. It includes ComponentMaterial element.
ComponentMaterial	Describes each ingredient contained in the composite material.
CompositeRatio	Specifies the ratio of the material constituents, in value between 0 and 1.

Name	Definition
SupportedColorType	Specifies the colour that is supported by the printer. This type is abstract and cannot be instantiated.
MonochromeColorType	Specifies the colour in RGB, when only a single colour can be provided.
Color	Specifies a single RGB colour, either by a reference to a classification scheme term or as an 8 bit RGB value. A CS that may be used for this purpose is the ColorCS defined in A.2.2.
MultiColorType	Specifies a list of colours, when only a predefined set of colours can be provided.
ColorEntry	Specifies a single RGB colour as one of the multiple supported colours, either by a reference to a classification scheme term or as an 8 bit RGB value. A CS that may be used for this purpose is the ColorCS defined in A.2.2.
NaturalColorType	Specifies if the printer can support coloured object by mixing colours.

5.18.5 Examples

This example shows the description of a 3D printer's capability with the following semantics. This is Good3D model from My3D with the brand name of Good. This is a printer using FDM technology, which is Fused Deposition Modelling, with a single head. More information on this printer can be found at http://www.my3Dprinter.com. This printer uses metallic powder type material to print. Available material is a metallic powder composed of 99.9 percent copper, named "Ultra super alloy" from "Posco". This printer can print objects given in ".obj" type or ".fbx" type formats. The maximum size that this printer can print is 14 × 14 × 14 inch[3].

```
<cidl:ControlInfo>
   <cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability
xsi:type="dcdv:ThreeDPrintingCapabilityType">
         <dcdv:GeneralDescription printerManufacturer="My3D"
printerBrand="Good" printerModel="Good3D" numPrinterHead="1"
printingTechnologyType="urn:mpeg:mpeg-v:01-SI-3DPrinterType-NS:FDM"/>
         <dcdv:SupportedPrintingMaterial
printingMaterialClass="dcdv:MetallicPowder:metalc"
printingMaterialProvider="Posco" printingMaterialName="5086 aluminium
alloy"/>
                  <dcdv:SupportedPrintingMaterial
printingMaterialClass="dcdv:food:chocolate"
printingMaterialProvider="GODIVA" printingMaterialName="Pearl Chocolate
Milk"/>
         <dcdv:MaximumPrintSize maxWidth="14" maxDepth="14"
maxHeight="14" unit="inch"/>
         <dcdv:ServiceRelatedCapabilities>
```

```
            <dcdv:SupportedFileType>urn:mpeg:mpeg-v:01-SI-
3DPrinterFileFormatType-NS:OBJ</dcdv:SupportedFileType>
            <dcdv:SupportedFileType>urn:mpeg:mpeg-v:01-SI-
3DPrinterFileFormatType-NS:FBX</dcdv:SupportedFileType>
            <dcdv:FastestDelivery timeUnit="day">2</dcdv:FastestDelivery>
         </dcdv:ServiceRelatedCapabilities>
      </cidl:SensoryDeviceCapability>
</cidl:SensoryDeviceCapabilityList>
</cidl:ControlInfo>
```

This example shows a 3D printer colour reproduction capability with a look-up-table in RGB to XYZ for 3D printing colour reproduction.

```
<cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability
xsi:type="dcdv:ThreeDPrintingCapabilityType">
         <dcdv:ThreeDPrintingXYZLUT mpeg7:dim="216 6"/>
            0   0   0      6.356 6.546 6.649
            1530   0      23.74817.1597.275
            2550   0      30.25520.75 8.332
            0   1530      22.88730.22311.896
            1531530      29.96531.94211.511
            2551530      42.15936.77710.938
            0   2550      26.67435.94212.505
            1532550      31.80539.35912.085
            2552550      48.44551.43211.744
            0   0   153   11.22910.09921.608
            1530   153   21.39115.18821.378
            2550   153   33.71522.59720.104
            0   153153   19.04625.28524.029
            153153153   30.63830.86724.048
            255153153   43.15235.95922.24
            0   0   255   12.94412.22124.106
            1530   255   19.45116.54426.69
            2550   255   34.61222.67924.518
            0   153255   26.49627.50539.125
            153153255   30.70729.85939.032
            255153255   49.30140.36141.563
            0   255255   34.92141.87 47.833
            153255255   43.66348.83248.937
            255255255   60.09 61.59553.152
         </dcdv:ThreeDPrintingXYZLUT>
      </cidl:SensoryDeviceCapability>
</cidl:SensoryDeviceCapabilityList>
```

This example shows a 3D printer colour reproduction capability with a look-up-table in RGB to light spectrum for 3D printing colour reproduction.

```
<cidl:SensoryDeviceCapabilityList>
      <cidl:SensoryDeviceCapability
xsi:type="dcdv:ThreeDPrintingCapabilityType">
         <dcdv:ThreeDPrintingSpectrumLUT mpeg7:dim="216 37">
            0   0   0      0.04530.05020.05380.05920.06750.07680.08680.0965
   0.102 0.10090.09520.08490.07260.06550.06230.05460.046 0.04690.0606
   0.077 0.079 0.07040.06040.05430.05720.06790.07220.06830.07880.1257
   0.1934
```

```
   153 0  0     0.13270.19540.25370.29430.31020.29970.27840.24960.215
0.18330.15780.13370.11190.09990.09390.08230.06990.07090.08840.1067
0.10640.09610.08510.07850.08240.09470.09680.08950.10340.16440.2469
   255 0  0     0.14770.21670.27880.32150.33920.32930.30980.28250.2486
0.21660.19010.16430.14030.12630.11890.10470.08950.08960.10720.1236
0.11980.108 0.09680.09010.09460.10780.10970.10170.11570.176 0.2554
   0   1530     0.06950.07560.079 0.08430.095 0.10930.13040.16210.2051
0.25460.30380.34490.37030.38180.38080.35960.32560.30040.28540.2675
0.23810.21130.18970.17660.18320.20520.20970.19560.21350.29410.3938
   153 1530     0.13080.17590.207 0.22990.25270.27260.29790.32860.3558
0.37360.38030.37340.35510.33480.31310.27920.24030.21480.20130.1869
0.16440.14520.13010.12150.12760.14470.14680.13550.15280.22760.3215
   255 1530     0.22020.34590.45450.50990.52370.50680.48990.468 0.4379
0.40730.37970.35  0.31940.29880.28570.26180.235 0.23170.25220.2655
0.25040.22980.21320.204 0.21180.23  0.22640.20790.22680.31020.4057
   0   2550     0.065 0.07360.07810.084 0.09550.11150.13460.17010.2182
0.27520.33470.39010.43350.45880.46390.44720.41280.37370.33510.3013
0.26730.23980.21750.20350.21070.23440.23840.22240.24240.32720.4261
   153 2550     0.13280.172 0.19470.20970.22910.25030.28130.32420.3737
0.42220.46380.49440.51150.51430.50320.47750.43980.40090.36380.332
0.30040.27570.256 0.244 0.25250.27530.27590.25820.27850.36290.4564
   255 2550     0.22990.38950.53190.59980.614 0.59470.58560.57970.5697
0.561 0.55340.54520.53490.51950.49760.46570.42540.38640.35080.3205
0.29030.26820.25170.24170.25  0.26960.26410.243 0.26490.35380.4484
   0   0  153   0.04890.05430.05770.06150.06870.07820.09070.10530.1185
0.12520.125 0.11680.10410.09710.09580.088 0.07950.09240.14730.251
0.35350.40250.40680.39930.40630.42610.42450.40420.41760.47730.5359
   153 0  153   0.16390.24080.29870.31750.31430.29310.26550.23390.1988
0.168 0.14460.123 0.104 0.09470.092 0.08360.07540.08690.13440.2162
0.28170.30080.292 0.28150.289 0.31060.31010.29210.31270.39420.4775
   255 0  153   0.17840.26650.33940.374 0.37990.36120.33580.30450.2671
0.23310.20580.17960.15500.14240.13690.12450.11150.11970.15860.2065
0.22150.21130.19610.18620.19240.20960.20830.19260.21030.28920.385
   0   153153   0.06870.07510.079 0.08420.09430.10830.129 0.15930.1986
0.24040.27850.30410.31410.31920.32290.31070.29130.30030.34650.3889
0.38450.35830.33150.31430.32110.34570.34820.32910.34750.42750.5128
   153 153153   0.13970.19480.22860.24570.26360.27890.30.32370.3407
0.34720.3447 0.331 0.31020.29710.29090.27290.252 0.26370.31740.3697
0.37220.35030.32730.31280.31960.34050.33730.31620.33640.418 0.4991
   255 153153   0.21880.35620.47240.52150.52740.50460.48430.46140.4303
0.39930.372 0.34280.31350.29530.28570.26560.24370.25090.29240.3286
0.31360.30310.285 0.27440.28210.30020.29340.271 0.29030.37340.4601
   0   0  255   0.05920.06530.06870.07270.08090.09130.10440.11980.1322
0.13760.13650.12750.114 0.107 0.10570.09780.089 0.10350.16490.2855
0.42460.51850.55850.57140.57870.58460.57960.56660.56880.58780.6065
   153 0  255   0.15260.212 0.25250.26640.27080.26530.25570.24  0.2156
0.19060.16880.14720.12730.11740.115 0.10630.098 0.11450.17990.3068
0.44870.53920.57670.58980.59360.59330.58910.58320.58170.58380.5881
   255 0  255   0.17450.27030.34370.365 0.35760.33180.303 0.27  0.2325
0.19890.17260.14820.126 0.11530.11220.10270.09380.11120.181 0.3127
0.45430.54170.57720.58940.59330.59330.58870.58190.58110.58470.5898
   0   153255   0.06330.07080.07420.07950.08960.10350.12360.15320.1902
0.22780.25980.27850.28210.28440.28930.28  0.26670.29380.39040.5208
0.59840.61530.61150.60620.60550.60760.60280.59240.59450.60880.6229
```

```
      153 153255   0.13570.18540.21470.22850.244 0.25810.278 0.29990.3145
   0.31820.31350.29820.27680.26490.262 0.24780.23330.26180.36310.5039
   0.59310.61660.61660.61390.61170.60970.60530.59950.59860.60140.606
      255 153255   0.24730.40370.53340.57540.569 0.53680.51050.48190.4459
   0.41130.382 0.35160.32180.30570.30090.286 0.27190.30150.40230.5381
   0.62130.64280.64280.64050.63850.63590.63150.62620.62490.62720.6318
      0   255255   0.06090.06790.07170.07660.08690.10150.12350.15740.2049
   0.26230.32490.38790.44460.49130.52620.54730.55720.56720.57530.5799
   0.57710.57140.56490.55950.56130.56850.56780.55960.56420.58330.6009
      153 255255   0.13970.17730.19770.21  0.22790.24850.27980.32430.3782
   0.43410.48520.52810.56130.585 0.60150.61010.61340.62040.62730.6332
   0.63430.63310.63140.62970.63030.63310.63380.63160.63340.63920.6463
      255 255255   0.28070.47030.63430.68990.686 0.65440.64040.63170.6212
   0.61470.61170.61060.61150.61220.61310.61210.60960.61330.618 0.6223
   0.62330.62280.62160.62030.62040.62240.62330.62190.62320.62680.6316
            </dcdv:ThreeDPrintingSpectrumLUT>
         </cidl:SensoryDeviceCapability>
</cidl:SensoryDeviceCapabilityList>
```

5.19 Arrayed Light capability type

5.19.1 General

This subclause specifies syntax and semantics of capabilities of arrayed light devices.

5.19.2 Syntax

```
<complexType name="ArrayedLightCapabilityType">
  <complexContent>
    <extension base="dcdv:LightCapabilityType">
      <attribute name="nbrOfRows" type="nonNegativeInteger"
use="optional"/>
     <attribute name="nbrOfColumns" type="nonNegativeInteger"
use="optional"/>
     <attribute name="horizontalSize" type="nonNegativeInteger"
use="optional"/>
     <attribute name="verticalSize" type="nonNegativeInteger"
use="optional"/>
    </extension>
  </complexContent>
</complexType>
```

5.19.3 Binary Representation Syntax

ArrayedLightCapabilityType {	Number of bits	Mnemonic
nbrOfRowsFlag	1	bslbf
nbrOfColumnsFlag	1	bslbf
horizontalSizeFlag	1	bslbf
verticalSizeFlag	1	bslbf

LightCapability		LightCapabilityType
if(nbrOfRowsFlag) {		
nbrOfRows	16	uimsbf
}		
if(nbrOfColumnsFlag) {		
nbrOfColumns	16	uimsbf
}		
if(horizontalSizeFlag) {		
horizontalSize	32	fsfb
}		
if(verticalSizeFlag) {		
verticalSize	32	fsfb
}		
}		

5.19.4 Semantics

Semantics of the `ArrayedLightCapabilityType`.

Name	Definition
`ArrayedLightCapabilityType`	Tool for describing the capability of an arrayed light based on `LightCapabilityType`. The attribute of `ArrayedLightCapabilityType` such as colour, unit, `maxIntensity`, and `numOfLightLevels`, is inherited from the `LightCapabilityType`. The matrix can be determined by the attribute of `nbrOfRows` and `nbrOfColumns`.
`nbrOfRowsFlag`	The field, which is represented in binary, indicates the presence of `nbrOfRows`. If it is 1, the `nbrOfRows` is present; otherwise it is not present.
`nbrOfColumnsFlag`	The field, which is represented in binary, indicates the presence of the `nbrOfColumns`. If it is 1, the `nbrOfRows` is present; otherwise it is not present.
`nbrOfRows`	This field specifies the maximum number of rows that the light actuator supports.

Name	Definition
NbrOfColumns	This field specifies the maximum number of columns that the light actuator supports.
horizontalSizeFlag	The field, which is represented in binary, indicates the presence of horizontalSize. If it is 1, the horizontalSize is present; otherwise it is not present.
verticalSizeFlag	The field, which is represented in binary, indicates the presence of verticalSize. If it is 1, the verticalSize is present; otherwise it is not present.
horizontalSize	This field specifies the actual horizontal size of a light array actuator in metres.
verticalSize	This field specifies the actual vertical size of a light array actuator in metres.
LightCapabilityType	Describes the capability of a light.

5.19.5 Examples

The example shows the description of an arrayed light capability with the following semantics. The arrayed light identifier is "arrayedlight1". There are 100 light levels in the range of the maximum and minimum intensity. The colours supported by the light are "white", "black", "red", "blue", and "green" from the classification scheme described in ISO/IEC 23005-6: —, A.2.2. The maximum number of rows and columns of the arrayed lighting device is 100, and the actual horizontal/vertical size of the device is 2 metre and 1.5 metre, respectively.

```
<cidl:SensoryDeviceCapabilityList>
  <cidl:SensoryDeviceCapability xsi:type="dcdv:ArrayedLightCapabilityType"
id="arrayedlight1" unit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:nit"
numOfLightLevels="100" nbrOfRows="100" nbrOfColumns="100"
horizontalSize="2" verticalSize="1.5">
    <dcdv:Color>urn:mpeg:mpeg-v:01-SI-ColorCS-NS:white</dcdv:Color>
    <dcdv:Color>urn:mpeg:mpeg-v:01-SI-ColorCS-NS:black</dcdv:Color>
    <dcdv:Color>urn:mpeg:mpeg-v:01-SI-ColorCS-NS:red</dcdv:Color>
    <dcdv:Color>urn:mpeg:mpeg-v:01-SI-ColorCS-NS:blue</dcdv:Color>
    <dcdv:Color>urn:mpeg:mpeg-v:01-SI-ColorCS-NS:green</dcdv:Color>
  </cidl:SensoryDeviceCapability>
</cidl:SensoryDeviceCapabilityList>
```


5.20 Sound display capability type

5.20.1 General

The capability of sound display unit can be explained by the ranges of sound signals generated with each sound display unit. This description contains the core features to understand the device capability about a particular sound display unit.

5.20.2 Syntax

```
<complexType name="SoundDisplayCapabilityType">
```

```
 <complexContent>
  <extension base="cidl:SensoryDeviceCapabilityBaseType">
   <sequence>
    <element name="ResponseFrequency" type="scdv:SignalRangeType "
minOccurs="0"/>
    <element name="OutVoltageRange" type="scdv:OutVoltageType"
minOccurs="0"/>
    <element name="ImpedanceRange" type="scdv:SignalRangeType"
minOccurs="0"/>
    <element name="SensitivityRange" type="scdv:SignalRangeType"
minOccurs="0"/>
    <element name="ControllableBandList" minOccurs="0">
     <complexType>
      <sequence>
       <element name="SubBandRange" type="scdv:BandRangeType"
minOccurs="1" maxOccurs="unbounded"/>
      </sequence>
      <attribute name="bandCount" use="optional" type="integer"/>
     </complexType>
    </element>
    <element name="SoundPressureRange" type="scdv:SignalRangeType"
minOccurs ="0"/>
   </sequence>
  </extension>
 </complexContent>
</complexType>

<complexType name="OutVoltageType">
 <sequence>
  <element name="PeakMusicPowerOutput" type="scdv:SignalRangeType"/>
  <element name="RootMeanSquareValues" type="scdv:SignalRangeType "/>
 </sequence>
</complexType>

<complexType name="SignalRangeType">
 <sequence>
  <element name="Min" type="float" minOccurs="0" maxOccurs="1"/>
  <element name="Max" type="float" minOccurs="0" maxOccurs="1"/>
 </sequence>
 <attribute name="unit" type="mpeg7:termReferenceType"/>
</complexType>

<complexType name="BandRangeType">
 <sequence>
  <element name="MinFrequency" type="float" minOccurs="0" maxOccurs=
"1"/>
  <element name="MaxFrequency" type="float" minOccurs="0" maxOccurs=
"1"/>
 </sequence>
 <attribute name="unit" type="mpeg7:termReferenceType"/>
 <attribute name="bandID" type="string" use="required"/>
</complexType>
```

5.20.3 Binary representation syntax

	Number of bits	Mnemonic
SoundDisplayCapabilityType {		
ResponseFrequencyFlag	*1*	bslbf
OutVoltageRangeFlag	*1*	bslbf
ImpedanceRangeFlag	*1*	bslbf
SensitivityRangeFlag	*1*	bslbf
ControllableBandListFlag	*1*	bslbf
SoundPressureRangeFlag	*1*	bslbf
SensoryDeviceCapabilityBaseType		SensoryDeviceCapabilityBaseType
if (ResponseFrequencyFlag) {		
ResponseFrequency		ResponseFrequencyType
}		
if (OutVoltageRangeFlag) {		
OutVoltageRange		OutVoltageType
}		
if (ImpedanceRangeFlag) {		
ImpedanceRange		SignalRangeType
}		
if (SensitivityRangeFlag) {		
SensitivityRange		SignalRangeType
}		
if (ControllableBandListFlag) {		
SubBandRangeCount		vluimsbf5
for(k=0;k<SubBandRangeCount;k++){		
SubBandRange		BandRangeType
}		

	Number of bits	Mnemonic
if (BandRangeFlag) {		
BandRange		
}		
if (SoundPressureRangeFlag) {		
SoundPressureRange		SignalRangeType
}		
SensoryDeviceCapabilityBaseType		SensoryDeviceCapabilityBaseType
}		
OutVoltageType {		
PeakMusicPowerOutput		SignalRangeType
RootMeanSquareValues		SignalRangeType
}		
SignalRangeType {		
MinFlag	*1*	bslbf
MaxFlag	*1*	bslbf
if (MinFlag) {		
Min	32	fsbf
}		
if (MaxFlag) {		
Max	32	fsbf
}		
Unit		termReferenceType
}		
BandRangeType {		
MinFrequencyFlag	*1*	bslbf

	Number of bits	Mnemonic
MaxFrequencyFlag	*1*	bslbf
if (MinFrequency) {		
MinFrequency	32	fsbf
}		
if (MaxFrequency) {		
MaxFrequency	32	fsbf
}		
Unit		unitTypeCS
bandIDLength		vluimsbf5
bandID	*bandIDLength *8*	bslbf
}		

5.20.4 Semantics

Semantics of the `SoundDisplayCapabilityType`.

Name	Definition
`SoundDisplayCapabilityType`	Tool for describing audio capability based on `SensoryDeviceCapabilityBasedType` including response frequency range, output voltage, impedance, sensitivity, range of frequency band, and sound pressure.
`ResponseFrequencyRange`	Specifies the capability of response frequency range values for a particular audio display unit. The coverage of the signal is represented with `ResponseFrequencyType`
`OutVoltageRange`	Describes the capability of output power of unit. The type of this element is `OutVoltageType`.
`ImpedanceRange`	Describes the announced impedance value expressing resistance of a particular speaker. The type of this element is `SignalRangeType` in `scdv`.
`SensitivityRange`	Sensitivity is a measure of sound pressure output referred to an input power of 1 W and to a distance of 1 m on the reference axis, and it is expressed in db scale (reference: 20 μ *Pa*). This element describes the range of sensitivity and refers to `SignalRangeType` in `scdv`.

Name	Definition
ControllableBandList	Describes a possible band ranges to control sound level of a specific frequency band. This element is composed of one or more SubBand elements whose types are BandRangeType in scdv and a bandCount attribute.
SubBand	This element describes the structures of subband ranges by describing minimum and maximum band with Min and Max element in BandRangeType.
bandCount	This attribute contains the number of subband ranges in ControllableBandList.
SoundPressureRange	Describes a possible range of sound pressure, and the sound pressure can be measures as a logarithmic measure of the effective pressure of a sound relative to a reference value (reference: 20 μ Pa). The type of this element is SignalRangeType in scdv.

Semantics of the SignalRangeType.

Name	Definition
SignalType	Specifies the range of values in a certain sound signal. The range of sound signal is represented with Min and Max elements.
Min	Describes the minimum value for impedance. The type of this element is float.
Max	Describes the maximum value for impedance. The type of this element is float.
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.

Semantics of the BandRangeType.

Name	Definition
MinFrequency	Describes the minimum value of frequency in a frequency band. The type of this element is float.
MaxFrequency	Describes the maximum value of frequency in a frequency band. The type of this element is float

Name	Definition
unit	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. The CS that may be used for this purpose is the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The binary representation of the UnitTypeCS is also defined in ISO/IEC 23005-6: —, A.2.1.
bandID	Describes the band ID for a particular subband.

Semantics of the OutVoltageType.

Name	Definition
OutVoltageType	Tool for describing output power of speaker which is in the audio display unit. The type include PeakMusicPowerOutput and RootMeanSquareValue.
PeakMusicPowerOutput	Describes the PMPO for a particular speaker. Peak music power output (PMPO) refers to the maximum power output achieved for a speaker system under perfect conditions. The type is this element is SignalRangeType in scdv.
RootMeanSquareValue	Describe the RMS value for a particular sound display unit. Root Mean Square (RMS) is an accurate mathematical representation of a speaker power output, and this element is alternative measure to PMPO. The type is this element is SignalRangeType in scdv.

5.20.5 Examples

This example shows a capability which capability id is 'spk0001'. In this capability description, the response frequency range is from 20 Hz to 20 000 Hz. The maximum impedance value is minimum 3.1 and maximum 8 Ω. Sensitivity range is minimum 87.3 dB and maximum 90 dB. In this example, that only one band can be adjusted is assumed, and generally many bands can exist. This device contains two subband ranges – 1 from 0 Hz to 1 500 Hz and 2 from 1 501 Hz to 8 000 Hz. SoundPressureRange is from 40 dB to 150 dB.

```
<cidl:SensoryDeviceCapabilityList>
  <cidl:SensoryDeviceCapability
xsi:type="scdv:SoundDisplayCapabilityType" xmlns:scdv="urn:mpeg:mpeg-
:2014:01-SCDV-NS" id="spk0001">
   <scdv:ImpedanceRange>
    <scdv:Min>3.1</scdv:Min>
    <scdv:Max>8</scdv:Max>
   </scdv:ImpedanceRange>
   <scdv:SensitivityRange>
    <scdv:Min>87.3</scdv:Min>
    <scdv:Max>90</scdv:Max>
   </scdv:SensitivityRange>
   <scdv:ControllableBandList bandCount="2">
```

```
    <scdv:SubBandRange bandID="1">
    <scdv:MinFrequency>0</scdv:MinFrequency>
    <scdv:MaxFrequency>1500</scdv:MaxFrequency>
   </scdv:SubBandRange>
   <scdv:SubBandRange bandID="2">
    <scdv:MinFrequency>1501</scdv:MinFrequency>
    <scdv:MaxFrequency>8000</scdv:MaxFrequency>
   </scdv:SubBandRange>
  </scdv:ControllableBandList>
  <scdv:SoundPressureRange>
   <scdv:Min>40</scdv:Min>
   <scdv:Max>150</scdv:Max>
   </scdv:SoundPressureRange>
  </cidl:SensoryDeviceCapability>
</cidl:SensoryDeviceCapabilityList>
```

6 Sensor capability description vocabulary

6.1 General

This sublause describes syntax and semantics of the sensor capability description vocabulary which comprises the following sensors.

- Light sensor
- Ambient noise sensor
- Temperature sensor
- Humidity sensor
- Distance sensor
- Atmospheric pressure sensor
- Position sensor
- Velocity sensor
- Acceleration sensor
- Orientation sensor
- Angular velocity sensor
- Angular acceleration sensor
- Pressure sensor
- Motion sensor
- Intelligent camera sensor
- Bend sensor
- Gas sensor
- Dust sensor
- Multi interaction point sensor
- Gaze tracking sensor
- Global position sensor
- Altitude sensor
- Weather sensor
- Camera sensor
- Engine oil temperature sensor
- Intake air temperature sensor
- Tire pressure monitor system sensor
- Distance travelled sensor
- Speed sensor
- Vehicle speed sensor
- Mass air flow sensor
- Fuel level sensor
- Manifold absolute pressure sensor
- EngineRPM sensor
- Radar sensor
- Array camera sensor

— Force sensor — Proximity sensor — E-Nose sensor

— Torque sensor — Body weight sensor — Microphone sensor.

NOTE SCDV has been designed in an extensible way and additional sensor capabilities can be added easily.

6.2 Schema wrapper conventions

The syntax defined in this subclause 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:2018:01-CT-NS" xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS"
xmlns:scdv="urn:mpeg:mpeg-v:2018:01-SCDV-NS"
targetNamespace="urn:mpeg:mpeg-v:2018:01-SCDV-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-2" 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: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:2018:01-CIDL-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/CIDL.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2018:01-CT-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-CT.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 General

This subclause specifies syntax and semantics of light sensor capabilities.

6.3.2 XML representation syntax

```
<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>
```

6.3.3 Binary representation syntax

LightSensorCapabilityType {	Number of bits	Mnemonic
ColorFlag	1	bslbf
LocationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(ColorFlag){		
LoopColor		vluimsbf5
for(k=0;k<LoopColor;k++){		
Color[k]		ColorType
}		
}		
if(LocationFlag){		
Location		Float3DVectorType
}		
}		
Float3DVectorType {		
X	32	fsbf
Y	32	fsbf
Z	32	fsbf
}		

6.3.4 Semantics

Semantics of the `LightSensorCapabilityType` type.

Name	Definition
`LightSensorCapabilityType`	Tool for describing a light sensor capability.

Name	Definition
ColorFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
LocationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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.
LoopColor	This field, which is only present in the binary representation, specifies the number of colours contained in the description.
Color	Describes the list of colours 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 ISO/IEC 15938-5:2003, 7.6. A CS that may be used for this purpose is the ColorCS defined in ISO/IEC 23005-6: —, A.2.2. EXAMPLE urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue would describe the colour 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 metre (m).

6.3.5 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 colour, #FF0000. 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>#FF0000</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 General

This subclause specifies syntax and semantics of ambient noise sensor capabilities.

6.4.2 XML representation syntax

```
<complexType name="AmbientNoiseSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.4.3 Binary representation syntax

AmbientNoiseSensorCapabilityType {	**Number of bits**	**Mnemonic**
LocationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(LocationFlag){		
Location		Float3DVectorType
}		
}		

6.4.4 Semantics

Semantics of the `AmbientNoiseSensorCapabilityType` type.

Name	**Definition**
`AmbientNoiseSensorCapabilityType`	Tool for describing an ambient noise sensor capability.
`LocationFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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).

Name	Definition
Location	Describes the location of the device from the global coordinate system according to the X-, Y-, and Z-axis in the unit of metre (m).

6.4.5 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 General

This subclause specifies syntax and semantics of temperature sensor capabilities.

6.5.2 XML representation syntax

```
<complexType name="TemperatureSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.5.3 Binary representation syntax

TemperatureSensorCapabilityType {	Number of bits	Mnemonic
LocationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(LocationFlag){		
Location		Float3DVectorType

}		
}		

6.5.4 Semantics

Semantics of the `TemperatureSensorCapabilityType` type.

Name	Definition
`TemperatureSensorCapabilityType`	Tool for describing a temperature sensor capability.
`LocationFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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 metre (m).

6.5.5 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 General

This subclause specifies syntax and semantics of humidity sensor capabilities.

6.6.2 XML representation syntax

```
<complexType name="HumiditySensorCapabilityType">
   <complexContent>
```

```
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.6.3 Binary representation syntax

HumiditySensorCapabilityType {	Number of bits	Mnemonic
LocationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(LocationFlag){		
Location		Float3DVectorType
}		
}		

6.6.4 Semantics

Semantics of the `HumiditySensorCapabilityType` type.

Name	Definition
`HumiditySensorCapability Type`	Tool for describing a humidity sensor capability.
`LocationFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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 metre (m).

6.6.5 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 1 000 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 General

This subclause specifies syntax and semantics of distance sensor capabilities.

6.7.2 XML representation syntax

```
<complexType name="DistanceSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.7.3 Binary representation syntax

DistanceSensorCapabilityType {	Number of bits	Mnemonic
LocationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(LocationFlag){		
Location		Float3DVectorType
}		
}		

6.7.4 Semantics

Semantics of the `DistanceSensorCapabilityType` type.

Name	Definition
`DistanceSensorCapability Type`	Tool for describing a distance sensor capability.

Name	Definition
LocationFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxValue	Describes the maximum value that the distance sensor can perceive in the unit of metre.
minValue	Describes the minimum value that the distance sensor can perceive in the unit of metre.
Location	Describes the location of the device from the global coordinate system according to the X-, Y-, and Z-axis in the unit of metre (m).

6.7.5 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 1 000 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 General

This subclause specifies syntax and semantics of atmospheric pressure sensor capabilities.

6.8.2 XML representation syntax

```
<complexType name="AtmosphericPressureSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Location" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.8.3 Binary representation syntax

AtmosphericPressureSensorCapabilityType {	Number of bits	Mnemonic
LocationFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(LocationFlag){		
Location		Float3DVectorType
}		
}		

6.8.4 Semantics

Semantics of the `AtmosphericPressureSensorCapabilityType` type.

Name	Definition
`AtmosphericPressure SensorCapabilityType`	Tool for describing an atmospheric pressure sensor capability.
`LocationFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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.

6.8.5 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 1 075 (hPa) and the minimum value shall be 910 (hPa) with the resolution of 1 650 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 General

This subclause specifies syntax and semantics of position sensor capabilities.

6.9.2 XML representation syntax

```
<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>
```

6.9.3 Binary representation syntax

PositionSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
Range		RangeType
}		
RangeType {		
XminValue	32	fsbf
XmaxValue	32	fsbf
YminValue	32	fsbf
YmaxValue	32	fsbf
ZminValue	32	fsbf
ZmaxValue	32	fsbf
}		

6.9.4 Semantics

Semantics of the `PositionSensorCapabilityType` type.

Name	Definition
`PositionSensorCapability Type`	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 ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.
`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 metre.
`XmaxValue`	Describes the maximum value that the position sensor can perceive along the X-axis in the unit of metre.
`YminValue`	Describes the minimum value that the position sensor can perceive along the Y-axis in the unit of metre.
`YmaxValue`	Describes the maximum value that the position sensor can perceive along the Y-axis in the unit of metre.
`ZminValue`	Describes the minimum value that the position sensor can perceive along the Z-axis in the unit of metre.
`ZmaxValue`	Describes the maximum value that the position sensor can perceive along the Z-axis in the unit of metre.

6.9.5 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 2 000 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 General

This subclause specifies syntax and semantics of velocity sensor capabilities.

6.10.2 XML representation syntax

```
<complexType name="VelocitySensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.10.3 Binary representation syntax

VelocitySensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.10.4 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 metre/second for the given axis.
`minValue`	Describes the minimum value that the velocity sensor can perceive in terms of metre/second for the given axis.

6.10.5 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 5 000 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 General

This subclause specifies syntax and semantics of acceleration sensor capabilities.

6.11.2 XML representation syntax

```
<complexType name="AccelerationSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.11.3 Binary representation syntax

AccelerationSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.11.4 Semantics

Semantics of the `AccelerationSensorCapabilityType` type.

Name	Definition
`AccelerationSensorCapabilityType`	Tool for describing an acceleration sensor capability.
`maxValue`	Describes the maximum value that the acceleration sensor can perceive in terms of m/s² for the given axis.
`minValue`	Describes the minimum value that the acceleration sensor can perceive in terms of m/s² for the given axis.

6.11.5 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/s²) and the minimum value shall be –9.8 (m/s²) with the resolution of 1000 levels. The accuracy of the sensor is 0.01 (m/s²). The offset of sensor is 0.5 (m/s²).

```
<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 General

This subclause specifies syntax and semantics of orientation sensor capabilities.

6.12.2 XML representation syntax

```
<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>
```

6.12.3 Binary representation syntax

OrientationSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
OrientationRange		OrientationRangeType
}		
OrientationRangeType {		
YawMin	32	fsbf
YawMax	32	fsbf
PitchMin	32	fsbf

OrientationSensorCapabilityType {	Number of bits	Mnemonic
PitchMax	32	fsbf
RollMin	32	fsbf
RollMax	32	fsbf
}		

6.12.4 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.
`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.

6.12.5 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" (rad) with the resolution of 1 000 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 General

This subclause specifies syntax and semantics of angular velocity sensor capabilities.

6.13.2 XML representation syntax

```
<complexType name="AngularVelocitySensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.13.3 Binary representation syntax

AngularVelocitySensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.13.4 Semantics

Semantics of the `AngularVelocitySensorCapabilityType` type.

Name	***Definition***
`AngularVelocitySensorCapabilityType`	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.

6.13.5 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 1 000 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 General

This subclause specifies syntax and semantics of angular acceleration sensor capabilities.

6.14.2 XML representation syntax

```
<complexType name="AngularAccelerationSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.14.3 Binary representation syntax

AngularAccelerationSensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.14.4 Semantics

Semantics of the `AngularAccelerationSensorCapabilityType` type.

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

6.14.5 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/s²) and the minimum value shall be –200.0 (rad/s²) with the resolution of 1 000 levels. The accuracy of the sensor is 0.1 (rad/s²). The offset of sensor is 0.5 (rad/s²).

```
<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 General

This subclause specifies syntax and semantics of force sensor capabilities.

6.15.2 XML representation syntax

```
<complexType name="ForceSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.15.3 Binary representation syntax

ForceSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.15.4 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.

6.15.5 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 General

This subclause specifies syntax and semantics of torque sensor capabilities.

6.16.2 XML representation syntax

```
<complexType name="TorqueSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.16.3 Binary representation syntax

TorqueSensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.16.4 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 millimetre) for each axis.
`minValue`	Describes the minimum value that the torque sensor can perceive in terms of N-mm (Newton millimetre) for each axis.

6.16.5 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 20 000 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 General

This subclause specifies syntax and semantics of pressure sensor capabilities.

6.17.2 XML representation syntax

```
<complexType name="PressureSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.17.3 Binary representation syntax

PressureSensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.17.4 Semantics

Semantics of the `PressureSensorCapabilityType`.

Name	Definition
`PressureSensorCapabilityType`	Tool for describing a pressure sensor capability.
`maxValue`	Describes the maximum value that the pressure sensor can perceive in terms of N/mm² (Newton/millimetre square) for each axis.
`minValue`	Describes the minimum value that the pressure sensor can perceive in terms of N/mm² (Newton/millimetre square) for each axis.

6.17.5 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/mm²) and the minimum value shall be 0.0 (N/mm²) with the resolution of 2 500 levels. The accuracy of the sensor is 0.001 (N/mm²). The offset of sensor is 0.05 (N/mm²).

```
<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 General

This subclause specifies syntax and semantics of motion sensor capabilities.

6.18.2 XML representation syntax

```
<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>
```

6.18.3 Binary representation syntax

MotionSensorCapabilityType {	Number of bits	Mnemonic
PositionCapabilityFlag	1	bslbf
OrientationCapabilityFlag	1	bslbf
VelocityCapabilityFlag	1	bslbf
AngularVelocityCapabilityFlag	1	bslbf
AccelerationCapabilityFlag	1	bslbf
AngularAccelerationCapabilityFlag	1	bslbf

MotionSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
if(PositionCapabilityFlag){		
PositionCapability		PositionSensorCapabilityType
}		
if(OrientationCapabilityFlag){		
OrientationCapability		OrientationSensorCapabilityType
}		
if(VelocityCapabilityFlag){		
VelocityCapability		VelocitySensorCapabilityType
}		
if(AngularVelocityCapabilityFlag){		
AngularVelocityCapability		AngularVelocitySensorCapabilityType
}		
if(AccelerationCapabilityFlag){		
AccelerationCapability		AccelerationSensorCapabilityType
}		
if(AngularAccelerationCapabilityFlag){		
AngularAccelerationCapability		AngularAccelerationSensorCapabilityTyp e
}		
}		

6.18.4 Semantics

Semantics of the `MotionSensorCapabilityType` type.

Name	Definition
`MotionSensorCapabilityType`	Tool for describing a motion sensor capability.

Name	Definition
PositionCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
OrientationCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
VelocityCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
AngularVelocityCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
AccelerationCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
AngularAccelerationCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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.
AngularVelocity Capability	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.
AngularAcceleration Capability	Describes the capability with respect to the angular acceleration as defined in AngularAccelerationSensorCapabilityType.

6.18.5 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 General

This subclause specifies syntax and semantics of intelligent camera sensor capabilities.

6.19.2 XML representation syntax

```
<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>
```


6.19.3 Binary representation syntax

IntelligentCameraCapabilityType {	Number of bits	Mnemonic
MaxBodyFeaturePointFlag	1	bslbf
MaxFaceFeaturePointFlag	1	bslbf
TrackedFeatureFlag	1	bslbf
TrackedFacialFeaturePointsFlag	1	bslbf
TrackedBodyFeaturePointsFlag	1	bslbf
featureTrackingStatusFlag		

IntelligentCameraCapabilityType {	Number of bits	Mnemonic
facialExpressionTrackingStatusFlag	1	bslbf
gestureTrackingStatusFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(MaxBodyFeaturePointFlag){		
MaxBodyFeaturePoint	32	uimsbf
}		
if(MaxFaceFeaturePointFlag){		
MaxFaceFeaturePoint	32	uimsbf
}		
if(TrackedFeatureFlag){		
TrackedFeature	2	bslbf
}		
if(TrackedFacialFeaturePointsFlag){		
TrackedFacialFeaturePoints		FacialFeatureMask
}		
if(TrackedBodyFeaturePointsFlag){		
TrackedBodyFeaturePointsFlag		BodyFeatureMask
}		
if(featureTrackingStatusFlag){		
featureTrackingStatus	1	bslbf
}		
if(facialExpressionTrackingStatusFlag){		
facialExpressionTrackingStatus	1	bslbf
}		
if(gestureTrackingStatusFlag){		
gestureTrackingStatus	1	bslbf

IntelligentCameraCapabilityType {	Number of bits	Mnemonic
}		
}		
FacialFeatureMask {		
LoopFaceFeaturePoint	8	uimsbf
for(k=0;k< LoopFaceFeaturePoint;k++){		
FaceFeaturePoint[k]	1	bslbf
}		
}		
BodyFeatureMask {		
LoopBodyFeaturePoint	16	uimsbf
for(k=0;k< LoopBodyFeaturePoint;k++){		
BodyFeaturePoint[k]	1	bslbf
}		
}		

6.19.4 Semantics

Semantics of the `IntelligentCameraCapabilityType` type.

Name	Definition
`IntelligentCameraCapabilityType`	Tool for describing an intelligent camera capability.
`MaxBodyFeaturePointFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`MaxFaceFeaturePointFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`TrackedFeatureFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`TrackedFacialFeaturePointsFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td></td><td>be used and “0” means the attribute shall not be used.</td></tr>
<tr><td>TrackedBodyFeaturePointsFlag</td><td>This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.</td></tr>
<tr><td>featureTrackingStatusFlag</td><td>This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.</td></tr>
<tr><td>facialExpressionTrackingStatusFlag</td><td>This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.</td></tr>
<tr><td>gestureTrackingStatusFlag</td><td>This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.</td></tr>
<tr><td>MaxBodyFeaturePoint</td><td>Describes the maximum number of body feature points that the intelligent camera can track.</td></tr>
<tr><td>MaxFaceFeaturePoint</td><td>Describes the maximum number of facial feature points that the intelligent camera can track.</td></tr>
<tr><td>TrackedFeature</td><td>Describes what kind of feature points can be tracked as given in FeatureType, e.g., body, face or both.</td></tr>
<tr><td>FeatureType</td><td>Describes the types of feature to be tracked. (face, body, or both).

In the binary description, the following mapping table is used.
<table>
<tr><th>Term of FeatureType</th><th>Binary representation for feature type (2 bits)</th></tr>
<tr><td>Face</td><td>00</td></tr>
<tr><td>Body</td><td>01</td></tr>
<tr><td>Both</td><td>10</td></tr>
<tr><td>Reserved</td><td>11</td></tr>
</table>
</td></tr>
<tr><td>TrackedFacialFeaturePoints</td><td>Describes whether each of the facial feature points orderly listed in ISO/IEC 23005-4:2018, 5.16 is active or not, based on FacialFeatureMask.</td></tr>
<tr><td>TrackedBodyFeaturePoints</td><td>Describes whether each of the body feature points orderly listed in ISO/IEC 23005-4:2018, 5.15 is active or not, based on BodyFeatureMask.</td></tr>
<tr><td>featureTracking</td><td>Describes whether the feature tracking is capable or not.</td></tr>
</table>

Name	Definition
Status	
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.
FacialFeatureMask	Provides a Boolean map of facial feature points in the order listed in ISO/IEC 23005-4:2018, 5.16 to identify active feature points.
BodyFeatureMask	Provides a Boolean map of body feature points in the order listed in ISO/IEC 23005-4:2018, 5.15 to identify active feature points.

6.19.5 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>
```


6.20 Bend sensor capability type

6.20.1 General

This subclause specifies syntax and semantics of bend sensor capabilities.

6.20.2 XML representation syntax

```
<complexType name="BendSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="Channels"
type="scdv:BendSensorChannelCapabilityType" minOccurs="0"
maxOccurs="unbounded"/>
         </sequence>
         <attribute name="numOfChannels" type="nonNegativeInteger"
use="optional" default="1"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="BendSensorChannelCapabilityType">
  <complexContent>
   <extension base="cidl:SensorCapabilityBaseType">
   <sequence>
      <element name="NumOfLocations" type="nonNegativeInteger"
minOccurs="0"/>
      <element name="DistanceBtwnLocations" type="float" minOccurs="0"/>
      <element name="NumOfAxes" type="nonNegativeInteger" minOccurs="0"/>
   </sequence>
   </extension>
  </complexContent>
</complexType>
```

6.20.3 Binary representation syntax

BendSensorCapabilityType{	Number of bits	Mnemonic
ChannelsFlag	1	bslbf
numOfChannelsFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(ChannelsFlag){		
LoopChannels		Vluimsbf5
for(k=0;k< LoopChannels;k++){		
Channels[k]		BendSensorChannelCapabilityTyp e
}		
}		
if(numOfChannelsFlag){		
numOfChannels	16	uimsbf

BendSensorCapabilityType{	Number of bits	Mnemonic
}		
}		
BendSensorChannelCapabilityType{		
NumOfLocationsFlag	1	bslbf
DistanceBtwnLocationsFlag	1	bslbf
NumOfAxesFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(NumOfLocationsFlag){		
NumOfLocations	16	uimsbf
}		
if(DistanceBtwnLocationsFlag){		
DistanceBtwnLocations	32	fsbf
}		
if(NumOfAxesFlag){		
NumOfAxes	2	uimsbf
}		
}		

6.20.4 Semantics

Semantics of the `BendSensorType`.

Name	Definition
`BendSensorCapabilityType`	Tool for describing a bend sensor capability.
`NumOfLocationsFlag`	This field, which is only present in the binary representation, indicates the presence of the "numOfLocations" attribute. A value of "1" implies that the attribute shall be used and a value of "0" implies that the attribute shall not be used.
`DistanceBtwnLocationsFlag`	This field, which is only present in the binary representation, indicates the presence of the "distanceBtwnLocations" attribute. A value of "1" implies that the attribute shall be used and a value of "0" implies that the attribute shall not be used.

Name	Definition
NumOfAxesFlag	This field, which is only present in the binary representation, indicates the presence of the "numOfAxes" attribute. A value of "1" implies that the attribute shall be used and a value of "0" implies that the attribute shall not be used.
numOfChannelsFlag	This field, which is only present in the binary representation, indicates the presence of the "numOfChannels" attribute. A value of "1" implies that the attribute shall be used and a value of "0" implies that the attribute shall not be used.
maxValue	Describes the maximum value that the bend sensor can perceive in terms of degree.
minValue	Describes the minimum value that the bend sensor can perceive in terms of degree.
NumOfLocations	Describes the number of locations that a bend sensor can sense bend angles.
DistanceBtwnLocations	Describes the distance between the adjacent sensing locations in terms of metre.
NumOfAxes	Describes the dimension that the bend sensor can perceive the bend angles.
numOfChannels	Describes the number of channels that an array of bend sensors can perceive. The default value of the number of channels is 1.

6.20.5 Examples

This example shows the description of a bend sensing capability with the following semantics. The sensor has an ID of "BendID_01" and the number of channels is 1. The channel has its ID of "Ch1", three sensing locations with a single axis, the distance between the sensing locations of 0.03 m, and the maximum and minimum values of 90 degrees and 0 degrees, respectively.

```
<cidl:SensorDeviceCapability xsi:type="scdv:BendSensorCapabilityType"
id="BendID_01" numOfChannels="1">
   <scdv:Channels id="Ch1" maxValue="90" minValue="0">
      <scdv:NumOfLocations>
         3
      </scdv:NumOfLocations>
      <scdv:DistanceBtwnLocations>
         0.03
      </scdv:DistanceBtwnLocations>
      <scdv:NumOfAxes>
         1
      </scdv:NumOfAxes>
   </scdv:Channels>
</cidl:SensorDeviceCapability>
```

6.21 Gas sensor capability type

6.21.1 General

This subclause specifies syntax and semantics of gas sensor capabilities.

6.21.2 XML representation syntax

```
<complexType name="GasSensorCapabilityType">
   <complexContent>
     <extension base="cidl:SensorCapabilityBaseType">
      <sequence>
          <element name="GasType" type="mpeg7:termReferenceType"
minOccurs="0"/>
      </sequence>
     </extension>
   </complexContent>
</complexType>
```

6.21.3 Binary representation syntax

GasSensorCapabilityType {	**Number of bits**	**Mnemonic**
GasTypeFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(GasTypeFlag){		
GasType	16	uimsbf
}		
}		

6.21.4 Semantics

Semantics of the `GasSensorCapabilityType`.

Name	**Definition**
`GasSensorCapabilityType`	Tool for describing a gas sensor capability.
`GasTypeFlag`	This field, which is only present in the binary representation, signals the presence of the GasType element. A value of "1" means the element shall be used and "0" means the element shall not be used.

Name	Definition
GasType	Describes the sensed type by the gas sensor. Tool for describing a gas type as a reference to a classification scheme term provided by GasTypeCS defined in ISO/IEC 23005-6: —, A.2.12.8. The details of the structure and use of classification scheme and termReferencetype description is defined in ISO/IEC 15938-5:2003, 7.6. EXAMPLE urn:mpeg:mpeg-v:01-CI-GasCS-NS:oxygen would describe Oxygen gas.
maxValue	Describes the maximum value that the gas sensor can perceive in terms of ppm (parts per million).
minValue	Describes the minimum value that the gas sensor can perceive in terms of ppm (parts per million).

6.21.5 Examples

This example shows the description of a gas sensing capability with the following semantics. The sensor has an ID of "GSID_01" and the maximum value shall be 25.0 (ppm) and the minimum value shall be 0.0 (ppm) with the resolution of 100 levels. The accuracy of the sensor is 0.001 (ppm). The offset of sensor is 0.05 (ppm).

```
<cidl:SensorDeviceCapability       xsi:type="scdv:GasSensorCapabilityType"
id="GSID_01"      minValue="0.0"      maxValue="25.0"      numOfLevels="100"
offset="0.05" unit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:ppm">
    <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.001"/>
</cidl:SensorDeviceCapability>
```

6.22 Dust sensor capability type

6.22.1 General

This subclause specifies syntax and semantics of dust sensor capabilities.

6.22.2 XML representation syntax

```
<complexType name="DustSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.22.3 Binary representation syntax

DustSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.22.4 Semantics

Semantics of the `DustSensorCapabilityType`:

Name	Definition
`DustSensorCapabilityType`	Tool for describing a dust sensor capability.
`maxValue`	Describes the maximum value that the dust sensor can perceive in terms of µg/m³ (micrograms per cubic metre).
`minValue`	Describes the minimum value that the dust sensor can perceive in terms of µg/m³ (micrograms per cubic metre).

6.22.5 Examples

This example shows the description of a dust sensing capability with the following semantics. The sensor has an ID of "DTID_01" and the maximum value shall be 1 000 (µg/m³) and the minimum value shall be 1 (µg/m³) with the resolution of 1 000 levels. The accuracy of the sensor is 1 (µg/m³). The offset of sensor is 5 (µg/m³).

```
<cidl:SensorDeviceCapability      xsi:type="scdv:DustSensorCapabilityType"
id="DSID_01" minValue="1" maxValue="1000" numOfLevels="1000" offset="5" >
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="1"/>
</cidl:SensorDeviceCapability>
```

6.23 Multi interaction point sensor capability type

6.23.1 General

This subclause specifies syntax and semantics of multi interataction point sensor capabilities.

6.23.2 XML representation syntax

```
<complexType name="MultiInteractionPointSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <attribute name="numOfInteractionPoints"
type="nonNegativeInteger" use="optional" default="1"/>
      </extension>
   </complexContent>
</complexType>
```

6.23.3 Binary representation syntax

MultiInteractionPointSensorCapabilityType {	Number of bits	Mnemonic
numOfInteractionPointsFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(numOfInteractionPointsFlag){		

numOfInteractionPoints	16	uimsbf
}		
}		

6.23.4 Semantics

Semantics of the `MultiInteractionPointSensorCapabilityType`.

Name	Definition
`MultiInteractionPointSensorCapabilityType`	Tool for describing a multi interaction-point sensor capability.
`numOfInteractionPointsFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`numOfInteractionPoints`	Describes the number of interaction points that a multi interaction point sensor includes.

6.23.5 Examples

The following is an example of the MultiInteractionPointSensorCapability to indicate the capable number of interaction points. This example shows that the given multi interaction point sensor with id of MIPS_ID1 has 5 interaction points to receive user's selection.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:MultiInteractionPointSensorCapabilityType" id="MIPSID_01"
numOfInteractionPoints="5"/>
```

6.24 Gaze tracking sensor capability type

6.24.1 General

This subclause specifies syntax and semantics of gaze tracking sensor capabilities.

6.24.2 XML representation syntax

```
<complexType name="GazeTrackingSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
          <sequence>
             <element name="PositionCapability"
type="scdv:PositionSensorCapabilityType" minOccurs="0"/>
             <element name="OrientationCapability"
type="scdv:OrientationSensorCapabilityType" minOccurs="0"/>
         </sequence>
         <attribute name="gazeTrackingOn" type="boolean" use="optional"
default="false"/>       <attribute name="blinkTrackingOn" type="boolean"
use="optional" default="false"/>
      </extension>
   </complexContent>
```

```
</complexType>
```

6.24.3 Binary representation syntax

GazeTrackingSensorCapabilityType {	Number of bits	Mnemonic
PositionCapabilityFlag	1	bslbf
OrientationCapabilityFlag	1	bslbf
gazeTrackingOnFlag	1	bslbf
blinkTrackingOnFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(PositionCapabilityFlag){		
PositionCapability		PositionSensorCapabilityType
}		
if(OrientationCapabilityFlag){		
OrientationCapability	1	OrientationSensorCapabilityType
}		
if(gazeTrackingOnFlag){		
gazeTrackingOn	1	bslbf
}		
if(blinkTrackingOnFlag){		
blinkTrackingOn	1	bslbf
}		
}		

6.24.4 Semantics

Semantics of the `GazeTrackingSensorCapabilityType`.

Name	Definition
`GazeTrackingSensorCapabilityType`	Tool for describing a Gaze tracking sensor capability.
`PositionCapabilityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the

<table>
<tr><th>Name</th><th>Definition</th></tr>
<tr><td></td><td>element shall be used and “0” means the element shall not be used.</td></tr>
<tr><td>OrientationCapabilityFlag</td><td>This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.</td></tr>
<tr><td>gazeTrackingOnFlag</td><td>This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.</td></tr>
<tr><td>blinkTrackingOnFlag</td><td>This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of “1” means the attribute shall be used and “0” means the attribute shall not be used.</td></tr>
<tr><td>PositionCapability</td><td>Describes the capability with respect to the position as defined in PositionSensorCapabilityType</td></tr>
<tr><td>OrientationCapability</td><td>Describes the capability with respect to the orientation as defined in OrientationSensorCapabilityType</td></tr>
<tr><td>gazeTrackingOn</td><td>Indicates whether the gaze tracking sensor can track user’s gazes or not. “false” means the gaze tracking sensor does not detect the gaze and “true” means the sensor does detect.

In the binary description, the following mapping table is used.
<table>
<tr><th>Binary value (1 bits)</th><th>whether detecting gaze or not</th></tr>
<tr><td>0</td><td>Not detecting gaze</td></tr>
<tr><td>1</td><td>Detecting gaze</td></tr>
</table>
</td></tr>
<tr><td>blinkTrackingOn</td><td>Indicates whether the gaze tracking sensor can detect the user’s blinking or not. “false“ means the gaze tracking sensor does not detect eye’s blinking and “true” means the sensor does detect.

In the binary description, the following mapping table is used.
<table>
<tr><th>Binary value (1 bits)</th><th>Whether detecting eye’s blinking or not</th></tr>
<tr><td>0</td><td>Not detecting eye’s blinking</td></tr>
<tr><td>1</td><td>Detecting eye’s blinking</td></tr>
</table>
</td></tr>
</table>

6.24.5 Examples

This example shows the description of a gaze tracking sensor capability with the following semantics. The sensor has an ID of “GTS001” and it can track the position and the orientation of user’s gaze while it cannot sense user’s blinking.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:GazeTrackingSensorCapabilityType" id="GTS001"
gazeTrackingOn="true" blinkTrackingOn="false"/>
```

6.25 Global position sensor capability type

6.25.1 General

This subclause specifies syntax and semantics of global position sensor capabilities.

6.25.2 XML representation syntax

```
<complexType name="GlobalPositionSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="VariousAccuracy"
type="scdv:VariousAccuracyType" minOccurs="0" maxOccurs="unbounded"/>
         </sequence>
         <attribute name="crs" type="anyURI"
default="urn:ogc:def:crs:EPSG::4326"/>
         <attribute name="latitudeOffset" type="float" use="optional"/>
         <attribute name="longitudeOffset" type="float" use="optional"/>
         <attribute name="maxOperatingTemp" type="float" use="optional"/>
         <attribute name="minOperatingTemp" type="float" use="optional"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="VariousAccuracyType">
   <attribute name="accuracyType" type="mpeg7:termReferenceType"/>
   <attribute name="value" type="float" use="required"/>
   <attribute name="accuracyUnit" type="mpeg7:termReferenceType"/>
</complexType>
```

6.25.3 Binary representation syntax

GlobalPositionSensorCapabilityType {	Number of bits	Mnemonic
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
latitudeOffsetFlag	1	bslbf
longitudeOffstFlag	1	bslbf
maxOperatingTempFlag	1	bslbf
minOperatingTempFlag	1	bslbf
VariousAccuracyCount	32	uimsbf
For (i=1;i<VariousAccuracyCount;i++) {		
AccuracyType	4	AccuracyTypeCS

GlobalPositionSensorCapabilityType {	Number of bits	Mnemonic
value	32	flbf
AccuracyUnit	8	bslbf
}		
crs	See ISO/IEC 10646[4]	UTF-8
if(latitudeOffsetFlag){		
latitudeOffset	32	fsbf
}		
if(longitudeOffsetFlag){		
longitudeOffset	32	Fsbf
}		
if(maxOperatingTempFlag){		
maxOperatingTemp	32	fsbf
}		
if(minOperatingTempFlag){		
minOperatingTemp	32	fsbf
}		
}		

6.25.4 Semantics

Semantics of the `GlobalPositionSensorCapabilityType`.

Name	Definition
`GlobalPositionSensorCapabilityType`	Tool for describing a GPS sensor capability.
`Accuracy`	Describes the degree of closeness of a measured quantity of longitude to its actual value in `AccuracyType`.
`LatitudeAccuracy`	Describes the degree of closeness of a measured quantity of latitude to its actual value in `AccuracyType`.
`unit`	Does not have any meaningful semantics in this description.
`maxValue`	Does not have any meaningful semantics in this description.

Name	Definition
minValue	Does not have any meaningful semantics in this description.
offset	Describes the value added to a base value of longitude in order to get to a specific absolute value.
VariousAccuracy	Describes the accuracy in various points of view. Each occurrence of this element defines one type of accuracy. This element defines the accuracy by using three attriubtes defined. The accuracyType attribute specifies the type of the accuracy by referencing the AccuracyTypeCS in A.2. The value attribute specifies the value to denote the accuracy. The unit attribute specifies the unit of the value attribute by referencing the UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1.
crs	Specifies the URI of the coordinate reference system based on which the values of longitude, latitude and altitude are given. The default is urn:ogc:def:crs:EPSG::4326 specifying the Coordinate Reference System (CRS) with code 4326 specified in the EPSG database available at http://www.epsg.org/.
longitudeOffset	Describes the value added to a base value of longitude in order to get to a specific absolute value.
latitudeOffset	Describes the value added to a base value of latitude 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 of longitude. 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.
maxOperatingTemp	Describes the number of locations that a bend sensor can sense bending angles.
minOperatingTemp	Describes the distance between the adjacent sensing locations.

Semantics of the VariousAccuracyType.

Name	Definition
VariousAccuracy	Tool for describing accuracy of the sensor in various points of view.
accuracyType	This attribute specifies the accuracy type, e.g., distance accuracy or

Name	Definition
	reacquisition time, by referencing to the `AccuracyTypeCS` in A.2.
`value`	This attribute specifies the value of the accuracy.
`accuracyUnit`	This attribute specifies the unit of the accuracy description by referenceing to the `UnitTypeCS` defined in ISO/IEC 23005-6: —, A.2.1.

6.25.5 Examples

This example shows the description of a global position sensor's sensing capability with the following semantics. The sensor has an ID of "gps01" with the maximum operating temperature of 90 °C, minimum operating temperature of −30 °C, sensitivity of 0.01 degrees, and the position accuracy of 0.01 degree.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:GlobalPositionSensorCapabilityType" id="gps01"
crs="urn:ogc:def:crs:EPSG::4326" maxOperatingTemp="90"
minOperatingTemp="-30" sensitivity="0.01">
<scdv:VariousAccuracy value="0.01" accuracyType="urn:mpeg:mpeg-v:01-
 AccuracyTypeCS-NS:PositionAccuracy" accuracyUnit="urn:mpeg:mpeg-v:01-CI-
 UnitTypeCS-NS:degree"/>
</cidl:SensorDeviceCapability>
```

6.26 Altitude sensor capability type

6.26.1 General

This subclause specifies syntax and semantics of altitude sensor capabilities.

6.26.2 XML representation syntax

```
<complexType name="AltitudeSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <attribute name="crs" type="anyURI"
default="urn:ogc:def:crs:EPSG::4326"/>
      </extension>
   </complexContent>
</complexType>
```

6.26.3 Binary representation syntax

AltitudeSensorCapabilityType {	Number of bits	Mnemonic
SensoryDeviceCapabilityBase		SensoryDeviceCapabilityBaseType
crs	See ISO/IEC 10646[4]	UTF-8

}		

6.26.4 Semantics

Semantics of the `AltitudeSensorCapabilityType`.

Name	Definition
`AltitudeSensorCapabilityType`	Tool for describing an altitude sensor capability.
`crs`	Specifies the URI of the coordinate reference system based on which the values of longitude, latitude and altitude are given. The default is urn:ogc:def:crs:EPSG::4326 specifying the Coordinate Reference System (CRS) with code 4326 specified in the EPSG database available at http://www.epsg.org/.
`Accuracy`	Describes the degree of closeness of a measured quantity to its actual value in `AccuracyType`.
`unit`	Specifies the unit of the sensor's measuring value as a reference to a classification scheme term provided by `UnitTypeCS` defined in ISO/IEC 23005-6: —, A.2.1, 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. The default unit is metre.
`maxValue`	Describes the maximum altitude that the altitude sensor can perceive in metres.
`minValue`	Describes the minimum altitude that the altitude sensor can perceive in metres.
`offset`	Describes the value needed to be added to a base value in order to get to a specific absolute value.
`numOfLevels`	Describes the number of altitude 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.

6.26.5 Examples

This example shows the description of an altitude sensing capability with the following semantics. The sensor has an ID of "ASID_01" and the maximum value shall be 1 000 (metre) and the minimum value

shall be 0 (metre) with the resolution of 2 000 levels. The accuracy of the sensor is 0.5 (metre). The offset of sensor is 5 (metre).

```
<cidl:SensorDeviceCapability xsi:type="scdv:AltitudeSensorCapabilityType"
id="ASID_01" minValue="0" maxValue="1000" numOfLevels="2000" offset="5" >
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.5"/>
</cidl:SensorDeviceCapability>
```

6.27 Weather sensor capability type

6.27.1 General

This subclause specifies syntax and semantics of weather sensor capabilities.

6.27.2 XML representation syntax

```
<complexType name="WeatherSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="TemperatureCapability"
type="scdv:TemperatureSensorCapabilityType" minOccurs="0"/>
            <element name="PrecipitationCapability" minOccurs="0">
               <complexType>
                  <complexContent>
                     <extension base="cidl:SensorCapabilityBaseType"/>
                  </complexContent>
               </complexType>
            </element>
            <element name="SnowCapability" minOccurs="0">
               <complexType>
                  <complexContent>
                     <extension base="cidl:SensorCapabilityBaseType"/>
                  </complexContent>
               </complexType>
            </element>
            <element name="WindCapability" minOccurs="0">
               <complexType>
                  <complexContent>
                     <extension base="cidl:SensorCapabilityBaseType"/>
                  </complexContent>
               </complexType>
            </element>
            <element name="HumidityCapability"
type="scdv:HumiditySensorCapabilityType" minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

6.27.3 Binary representation syntax

WeatherSensorCapabilityType {	Number of bits	Mnemonic
TemperatureCapabilityFlag	1	bslbf
PrecipitationCapabilityFlag	1	bslbf
SnowCapabilityFlag	1	bslbf
WindCapabilityFlag	1	bslbf
HumidityCapabilityFlag	1	bslbf
If (TemperatureCapabilityFlag) {		
TemperatureCapability		TemperatureSensorCapabilityType
}		
If (PrecipitationCapabilityFlag) {		
PrecipitationCapability		SensorCapabilityBaseType
}		
If (SnowCapabilityFlag) {		
SnowCapability		SensorCapabilityBaseType
}		
If (WindCapabilityFlag) {		
WindCapability		SensorCapabilityBaseType
}		
If (HumidityCapabilityFlag) {		
HumidityCapability		HumiditySensorCapabilityType
}		
}		

6.27.4 Semantics

Semantics of the `WeatherSensorCapabilityType`.

Name	Definition
WeatherSensorCapabilityType	Tool for describing capabilities of a weather sensor, which may be either a physical sensor or a virtual sensor that can produce weather information or can gather weather information in various means.
TemperatureCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the TemperatureCapability element. A value of "1" means that this element is present and "0" means that this element is not present.
PrecipitationCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the PrecipitationCapability element. A value of "1" means that this element is present and "0" means that this element is not present.
SnowCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the SnowCapability element. A value of "1" means that this element is present and "0" means that this element is not present.
WindCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the WindCapability element. A value of "1" means that this element is present and "0" means that this element is not present.
HumidityCapabilityFlag	This field, which is only present in the binary representation, signals the presence of the HumidityCapability element. A value of "1" means that this element is present and "0" means that this element is not present.
TemperatureCapability	Element to describe the temperature-related capability of a weather sensor. If this element is not instantiated, the given Weather sensor is unable to provide temperature information.
PrecipitationCapability	Element to describe the precipitation-related capability of a weather sensor. If this element is not instantiated, the given Weather sensor is unable to provide precipitation information.
SnowCapability	Element to describe the snow-related capability of a weather sensor. If this element is not instantiated, the given Weather sensor is unable to provide snow information.
WindCapability	Element to describe the wind-related capability of a weather sensor. If this element is not instantiated, the given Weather sensor is unable to provide wind information.
HumidityCapability	Element to describe the humiditY-related capability of a weather sensor. If this element is not instantiated, the given Weather sensor is unable to provide humidity information.

Name	Definition
sensorCapabilityBaseAttributes	There are sensorCapabilityBaseAttributes inherited from the SensorCapabilityBaseType at the top level of the WeatherSensorCapabilityType as well as at each individual capability description of temperature, precipitation, snow, wind and humidity sensor. In this capability description, the attributes defined in the sensorCapabilityBaseAttributes of the top level are disabled and not used except the id and sensorIdRef attributes.

6.27.5 Examples

The following is an example of the WeatherSensorCapabilityType to indicate that the capability of the given sensor. This example shows that the given weather sensor with id of WSC_ID1 can sense humidity, temperature, and snow. The humidity information can be provided between 5 % and 90 % with sensitivity of 1 %, the temperature information can be provided between 100 °C and –100 °C in 200 levels, and the snow information can be provided with maximum of 100 centimetres per minute, in 200 levels.

```
<cidl:SensorDeviceCapability xsi:type="scdv:WeatherSensorCapabilityType"
id="WSC_ID1">
   <scdv:TemperatureCapability maxValue="100" minValue="-100"
numOfLevels="200" unit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:celsius"/>
   <scdv:SnowCapability maxValue="100" numOfLevels="200"
unit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:centimeterperhour"/>
   <scdv:HumidityCapability maxValue="90" minValue="5" numOfLevels="90"
sensitivity="1"/>
</cidl:SensorDeviceCapability>
```

6.28 Camera sensor capability type

6.28.1 General

This subclause specifies syntax and semantics of camera sensor capabilities. This camera sensor capability supports the capapblities of the camera sensor, the spectrum camera sensor, the colour camera sensor, the depth camera sensor, the stereo camera sensor, and the thermographic camera sensor specified in ISO/IEC 23005-5.

6.28.2 XML representation syntax

```
<complexType name="CameraSensorCapabilityType">
  <complexContent>
    <extension base="cidl:SensorCapabilityBaseType">
      <sequence>
        <element name="SupportedResolutions" type="scdv:ResolutionListType"
minOccurs="0"/>
        <element name="FocalLengthRange" type="scdv:ValueRangeType"
minOccurs="0"/>
        <element name="ApertureRange" type="scdv:ValueRangeType"
minOccurs="0"/>
        <element name="ShutterSpeedRange" type="scdv:ValueRangeType"
minOccurs="0"/>
```

```
      <element name="ISOSpeedRange" type="scdv:ValueRangeType"
minOccurs="0"/>
      <element name="ExposureValueRange" type="scdv:ValueRangeType"
minOccurs="0"/>
      <element name="ColorFilterArrayType"
type="scdv:ColorFilterArrayListType" minOccurs="0"/>
      <element name="Video" type="boolean" minOccurs="0"/>
      <element name="SensorType" type="boolean" minOccurs="0"/>
      <element name="ColorSpaceType" type="string" minOccurs="0"/>
      <element name="BitDepthRange" type="scdv:ValueRangeType"
minOccurs="0"/>
      <element name="SpectrumRange" type="scdv:ValueRangeType"
minOccurs="0"/>
      <element name="ThermalRange" type="scdv:ValueRangeType"
minOccurs="0"/>
      <element name="WhiteBalanceTempRange" type="scdv:ValueRangeType"
minOccurs="0"/>
      <element name="WhiteBalanceTintRange" type="scdv:ValueRangeType"
minOccurs="0"/>
     </sequence>
    </extension>
  </complexContent>
</complexType>

<complexType name="ResolutionListType">
   <sequence>
      <element name="Resolution" type="scdv:ResolutionType"
maxOccurs="unbounded"/>
   </sequence>
</complexType>

<complexType name="ResolutionType">
   <sequence>
       <element name="Width" type="nonNegativeInteger"/>
      <element name="Height" type="nonNegativeInteger"/>
   </sequence>
</complexType>

<complexType name="ValueRangeType">
   <sequence>
      <element name="MaxValue" type="float"/>
      <element name="MinValue" type="float"/>
   </sequence>
</complexType>

<simpleType name="ColorFilterArrayListType">
   <restriction base="string">
       <enumeration value="Bayer"/>
       <enumeration value="RGBE"/>
       <enumeration value="CYYM"/>
       <enumeration value="CYGM"/>
       <enumeration value="RGB Bayer"/>
       <enumeration value="RGBW #1"/>
       <enumeration value="RGBW #2"/>
       <enumeration value="RGBW #3"/>
```

```
   </restriction>
</simpleType>
```

6.28.3 Binary representation

CameraSensorCapabilityType {	Number of bits	Mnemonic
SupportedResolutionsFlag	1	bslbf
FocalLengthRangeFlag	1	bslbf
ApertureRangeFlag	1	bslbf
ShutterSpeedRangeFlag	1	bslbf
ISORangeFlag	1	bslbf
ExposureValueRangeFlag	1	bslbf
ColorFilterFlag	1	bslbf
VideoFlag	1	bslbf
SensorType	1	bslbf
ColorSpaceFlag	1	bslbf
BitDepthRangeFlag	1	bslbf
SpectrumRangeFlag	1	bslbf
ThermalRangeFlag	1	bslbf
WhiteBalanceTempRangeFlag	1	bslbf
WhiteBalanceTintRangeFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if(SupportedResolutionsFlag) {		
SupportedResolutions		ResolutionListType
}		
if(FocalLengthRangeFlag) {		
FocalLengthRange		ValueRangeType
}		
if(ApertureRangeFlag) {		

CameraSensorCapabilityType {	Number of bits	Mnemonic
ApertureRange		ValueRangeType
}		
if(ShutterSpeedRangeFlag) {		
ShutterSpeedRange		ValueRangeType
}		
if(ISOSpeedRangeFlag) {		
ISOSpeedRange		ValueRangeType
}		
if(ExposureValueRangeFlag) {		
ExposureValueRange		ValueRangeType
}		
if(ColorFilterArrayFlag) {		
ColorFilterArrayType		ColorFilterArrayListType
}		
if(ColorSpaceFlag) {		
ColorSpaceTypeLength		vluimsbf
ColorSpaceType	See ISO/IEC 10646[4]	UTF-8
}		
if(BitDepthRangeFlag) {		
BitDepthRange		ValueRangeType
}		
if(SpectrumRangeFlag) {		
SpectrumRange		ValueRangeType
}		
if(ThermalRangeFlag) {		
ThermalRange		ValueRangeType

CameraSensorCapabilityType {	Number of bits	Mnemonic
}		
if(WhiteBalanceTempRangeFlag) {		
WhiteBalanceTempRange		ValueRangeType
}		
if(WhiteBalanceTintRangeFlag) {		
WhiteBalanceTintRange		ValueRangeType
}		
}		
ResolutionListType {		
LoopResolution		vluimsbf
for(k=0;k< LoopResolution;k++) {		
Resolution[k]		ResolutionType
}		
}		
ResolutionType {		
Width	32	uimsbf
Height	32	uimsbf
}		
ValueRangeType {		
MaxValue	32	fsbf
MinValue	32	fsbf
}		

6.28.4 Semantics

Semantics of the `CameraSensorCapabilityType`.

Name	Definition
CameraSensorCapabilityType	Tool for describing a camera sensor capability.
SupportedResolutionsFlag	This field, which is only present in the binary representation, signals the presence of the SupportedResolutions element. A value of "1" means that this element is present and "0" means that this element is not present.
SupportedResolutions	Describes a list of resolution that the camera can support.
ResolutionListType	Describes a type of the resolution list which is composed of ResolutionType element.
ResolutionType	Describes a type of resolution which is composed of Width element and Height element.
Width	Describes a width of resolution that the camera can perceive.
Height	Describes a height of resolution that the camera can perceive
FocalLengthRangeFlag	This field, which is only present in the binary representation, signals the presence of the FocalLengthRange element. A value of "1" means that this element is present and "0" means that this element is not present.
FocalLengthRange	Describes the range of the focal length that the camera sensor can perceive in terms of ValueRangeType. Its default unit is millimetres (mm). NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.
ValueRangeType	Defines the range of the value that the sensor can perceive.
MaxValue	Describes the maximum value that the sensor can perceive.
MinValue	Describes the minimum value that the sensor can perceive.
ApertureRangeFlag	This field, which is only present in the binary representation, signals the presence of the ApertureRange element. A value of "1" means that this element is present and "0" means that this element is not present.
ApertureRange	Describes the range of the aperture that the camera sensor can perceive in terms of valueRangeType. NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.

Name	Definition
ShutterSpeedRangeFlag	This field, which is only present in the binary representation, signals the presence of the ShutterSpeedRange element. A value of "1" means that this element is present and "0" means that this element is not present.
ShutterSpeedRange	Describes the range of the shutter speed that the camera sensor can perceive in terms of valueRangeType. Its default unit is seconds (sec). NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.
ISOSpeedRangeFlag	This field, which is only present in the binary representation, signals the presence of the ISOSpeedRange element. A value of "1" means that this element is present and "0" means that this element is not present.
ISOSpeedRange	Describes the range of ISO Speed based on ISO 12232:2006 that the camera sensor can perceive in terms of valueRangeType. NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.
ExposureValueRangeFlag	This field, which is only present in the binary representation, signals the presence of the ExposureValueRange element. A value of "1" means that this element is present and "0" means that this element is not present.
ExposureValueRange	Describes the range of the exposure value that the camera sensor can perceive in terms of valueRangeType. NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.
VideoFlag	A value of "0" means that this camera sensor can only shoot still image. A value of "1" means that this camera sensor can record video.
SensorType	A value of "0" means that this camera sensor can only perceive monochrome image. A value of "1" means that this camera sensor can perceive colour image.
ColorFilterArrayFlag	This field, which is only present in the binary representation, signals the presence of the ColorFilterArrayType element. A value of "1" means that this element is present and "0" means that this element is not present.

Name	Definition
ColorFilterArrayType	Describes the colour filter array applied to the image sensor of a camera 0000 Reserved 0001 Bayer 0010 RGBE 0011 CYYM 0100 CYGM 0101 RGBW Bayer 0110 RGBW #1 0111 RGBW #2 1000 RGBW #3 1001-1111 Reserved
ColorSpaceFlag	This field, which is only present in the binary representation, signals the presence of the ColorSpaceType element. A value of "1" means that this element is present and "0" means that this element is not present.
ColorSpaceType	Describes the colour space applied.
BitDepthRangeFlag	This field, which is only present in the binary representation, signals the presence of the BitDepthRange element. A value of "1" means that this element is present and "0" means that this element is not present.
BitDepthRange	Describes the range of the bit depth that the camera sensor can perceive in terms of valueRangeType. NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.
SpectrumRangeFlag	This field, which is only present in the binary representation, signals the presence of the SpectrumRange element. A value of "1" means that this element is present and "0" means that this element is not present.
SpectrumRange	Describes the spectrum range that the camera sensor can perceive in terms of valueRangeType. Its default unit is nanometre (nm). NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.

Name	Definition
ThermalRangeFlag	This field, which is only present in the binary representation, signals the presence of the ThermalRange element. A value of "1" means that this element is present and "0" means that this element is not present.
ThermalRange	Describes the thermal response range that the camera sensor can perceive in terms of valueRangeType. Its default unit is Celsius (°C). NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.
WhiteBalanceTempRangeFlag	This field, which is only present in the binary representation, signals the presence of the WhiteBalanceTempRange element. A value of "1" means that this element is present and "0" means that this element is not present.
WhiteBalanceTempRange	Describes the white balance temperature range that the camera sensor can perceive in terms of valueRangeType. Its default unit is Kelvin (K). NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.
WhiteBalanceTintFlag	This field, which is only present in the binary representation, signals the presence of the WhiteBalanceTintRange element. A value of "1" means that this element is present and "0" means that this element is not present.
WhiteBalanceTintRange	Describes the range of white balance tint value that the camera sensor can perceive in terms of valueRangeType. NOTE The minValue and the maxValue in the SensorCapabilityBaseType are not used for this sensor.

6.28.5 Examples

This example shows the description of a camera sensing capability with the following semantics. The camera sensor has an ID of "CSCID_001". The sensor has a list of the supported resolutions, 1 280 pixels by 720 pixels (width × height) and 1 920 pixels by 1 080 pixels. The maximum focal length of the sensor is 100 (mm) and the minimum focal length is 5 (mm). The maximum aperture of the sensor is F1.4 and the minimum aperture is F8. The maximum shutter speed of the sensor is 1 (sec) and the minimum shutter speed is 0.001 (sec).

```
<cidl:SensorDeviceCapability    xsi:type="scdv:CameraSensorCapabilityType"
id="CSCID_001">
   <scdv:SupportedResolutions>
      <scdv:Resolution>
         <scdv:Width>1280</scdv:Width>
         <scdv:Height>720</scdv:Height>
      </scdv:Resolution>
      <scdv:Resolution>
```

```
            <scdv:Width>1920</scdv:Width>
            <scdv:Height>1080</scdv:Height>
         </scdv:Resolution>
      </scdv:SupportedResolutions>
      <scdv:FocalLengthRange>
         <scdv:MaxValue>100</scdv:MaxValue>
         <scdv:MinValue>5</scdv:MinValue>
      </scdv:FocalLengthRange>
      <scdv:ApertureRange>
         <scdv:MaxValue>1.4</scdv:MaxValue>
         <scdv:MinValue>8</scdv:MinValue>
      </scdv:ApertureRange>
      <scdv:ShutterSpeedRange>
         <scdv:MaxValue>1</scdv:MaxValue>
         <scdv:MinValue>0.001</scdv:MinValue>
      </scdv:ShutterSpeedRange>
</cidl:SensorDeviceCapability>
```

6.29 Proximity sensor capability type

6.29.1 General

This subclause specifies syntax and semantics of proximity sensor capabilities.

6.29.2 XML representation syntax

```
<complexType name="ProximitySensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.29.3 Binary representation syntax

ProximitySensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapabilityBase		SensorCapabilityBaseType
}		

6.29.4 Semantics

Semantics of the `ProximitySensorCapabilityType`.

Name	**Definition**
`ProximitySensor CapabilityType`	Tool for describing a proximity sensor capability.
`maxValue`	Describes the maximum value that the proximity sensor can perceive in the unit of metre.
`minValue`	Describes the minimum value that the proximity sensor can perceive in the

Name	Definition
	unit of metre.

6.29.5 Examples

This example shows the description of a proximity sensing capability with the following semantics. The sensor has an ID of "PXS001" and the maximum value shall be 10 (m) and the minimum value shall be 0 (m) with the resolution of 1 000 levels. The accuracy of the sensor is 0.01 (m). The offset of the sensor is 0.1 (m).

```
<cidl:SensorDeviceCapability
xsi:type="scdv:ProximitySensorCapabilityType" id="PXS001" maxValue="10"
minValue="0" numOfLevels="1000" offset="0.1">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
</cidl:SensorDeviceCapability>
```

6.30 Body weight sensor capability type

6.30.1 General

This subclause specifies syntax and semantics of body weight sensor capabilities. This type supports the capabilities of the body weight sensor and the CoM sensor specified in ISO/IEC 23005-5.

6.30.2 XML representation syntax

```
<complexType name="BodyWeightSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
      </extension>
   </complexContent>
</complexType>
```

6.30.3 Binary representation syntax

BodyWeightSensorCapabilityType {	Number of bits	Mnemonic
SensoryCapabilityBase		SensoryCapabilityBaseType
}		

6.30.4 Semantics

Semantics of the BodyWeightSensorCapability Type.

Name	Definition
BodyWeightSensorCapabilityType	Tool for describing a body weight sensor capability.
maxValue	Describes the maximum value that the body weight sensor can perceive in the unit of kilograms.

6.30.5 Examples

This example shows the description of a body weight capability with the following semantics. The sensor has an ID of "BWSC001" and the maximum value shall be 200.0 (kg) with the resolution of 2 000 levels. The accuracy of the sensor is 0.01 (kg). The offset of sensor is 0.1 (kg).

```
<cidl:SensorDeviceCapability
xsi:type="scdv:BodyWeightSensorCapabilityType" id="BWSC001"
maxValue="200.0" numOfLevels="2000" offset="0.1">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.01"/>
</cidl:SensorDeviceCapability >
```

6.31 Engine oil temperature sensor capability type

6.31.1 General

This subclause specifies the capability description of the engine oil temperature sensors. The engine oil temperature sensor capability type is defined as an extension of Temperature Sensor Capability type.

6.31.2 XML representation syntax

```
<complexType name="EngineOilTemperatureSensorCapabilityType">
   <complexContent>
      <extension base="scdv:TemperatureSensorCapabilityType"/>
   </complexContent>
</complexType>
```

6.31.3 Binary representation syntax

EngineOilTemperatureSensorCapabilityType {	Number of bits	Mnemonic
TemperatureSensorCapability		TemperatureSensorCapabilityType
}		

6.31.4 Semantics

Semantics of the `EngineOilTemperatureSensorCapabilityType`.

Name	Definition
`EngineOilTemperatureSensorCapabilityType`	Tool for describing capability of the engine oil temperature sensor.

6.31.5 Examples

This example shows the description of an engine oil temperature sensing capability with the following semantics. The sensor has an ID of "EOTS001" and the maximum value shall be 120 (°C) and the minimum value shall be –20 (°C) with the resolution of 1 400 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:EngineOilTemperatureSensorCapabilityType" id="EOTS001"
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>
```

6.32 Intake air temperature sensor capability type

6.32.1 General

This subclause specifies a capability description of intake air temperature sensor. The intake air temperature sensor type is defined as an extension of Temperature Sensor type, and the intake air temperature sensor capability type is defined as an extension of temperature sensor capability type.

6.32.2 XML representation syntax

```
<complexType name="IntakeAirTemperatureSensorCapabilityType">
   <complexContent>
      <extension base="scdv:TemperatureSensorCapabilityType"/>
   </complexContent>
</complexType>
```

6.32.3 Binary representation syntax

IntakeAirTemperatureSensorCapabilityType {	**Number of bits**	**Mnemonic**
TemperatureSensorCapability		TemperatureSensorCapabilityType
}		

6.32.4 Semantics

Semantics of the `IntakeAirTemperatureSensorCapabilityType`.

Name	**Definition**
`IntakeAirTemperatureSensorCapabilityType`	Tool for describing the intake air temperature sensor capability.

6.32.5 Examples

This example shows the description of an intake air temperature sensing capability with the following semantics. The sensor has an ID of “IATS001” and the maximum value shall be 120 (°C) and the minimum value shall be –20 (°C) with the resolution of 1 400 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:IntakeAirTemperatureSensorCapabilityType"
   id="IATS001" 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>
```

6.33 Tire pressure monitor system sensor capability type

6.33.1 General

This subclause specifies a capability type of the tire pressure monitor system sensor.

6.33.2 XML representation syntax

```
<complexType name="TirePressureMonitorSystemSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.33.3 Binary representation syntax

TirePressureMonitorSystemSensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapability		SensorCapabilityBaseType
}		

6.33.4 Semantics

Semantics of the `TirePressureMonitorSystemSensorCapabilityType`.

Name	**Definition**
`TirePressureMonitorSystem SensorCapabilityType`	Tool for describing capability of a tire pressure monitor system sensor.

6.33.5 Examples

This example shows the description of a tire pressure monitor system sensor capability with the following semantics. The sensor has an ID of “TPMS001” and the maximum value shall be 100 and the minimum value shall be 0 with the resolution of 200 levels. The accuracy of the sensor is 0.5, the offset of sensor is 0.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:TirePressureMonitorSystemSensorCapabilityType"
id="TPMS001" maxValue="100" minValue="0" numOfLevels="200" offset="0.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.5"/>
</cidl:SensorDeviceCapability>
```

6.34 Distance travelled sensor capability type

6.34.1 General

This subclause specifies a capability of the distance travelled sensor type which senses total distance travelled by the vehicle.

6.34.2 XML representation syntax

```
<complexType name="DistanceTraveledSensorCapabilityType">
   <complexContent>
      <extension base="scdv:DistanceSensorCapabilityType"/>
   </complexContent>
</complexType>
```

6.34.3 Binary representation syntax

DistanceTraveledSensorCapabilityType {	**Number of bits**	**Mnemonic**
DistanceSensorCapability		DistanceSensorCapabilityType
}		

6.34.4 Semantics

Semantics of the `DistanceTraveledSensorCapabilityType`.

Name	**Definition**
`DistanceTraveledSensorCapabilityType`	Tool for describing capability of the sensor sensing the total distance traveled by a vehicle.

6.34.5 Examples

This example shows the description of a distance travelled sensor capability with the following semantics. The sensor has an ID of “DTS001” and the maximum value shall be 999 999 and the minimum value shall be 0 with the resolution of 99 999 999 levels. The accuracy of the sensor is 0.005, the offset of sensor is 0.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:DistanceTraveledSensorCapabilityType" id="DTS001"
maxValue="999999" minValue="0" numOfLevels="99999999" offset="0.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.005"/>
</cidl:SensorDeviceCapability>
```

6.35 Speed sensor capability type

6.35.1 General

This subclause specifies a capability of the speed sensor which senses the speed without the notion of moving direction.

6.35.2 XML representation syntax

```
<complexType name="SpeedSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.35.3 Binary representation syntax

SpeedSensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapability		SensorCapabilityBaseType
}		

6.35.4 Semantics

Semantics of the `SpeedSensorCapabilityType`.

Name	**Definition**
`SpeedSensorCapabilityType`	Tool for describing capability of the speed sensor, which does not specify any moving direction, unlike a velocity sensor.

6.35.5 Examples

This example shows the description of a speed sensor capability with the following semantics. The sensor has an ID of "SS001" and the maximum value shall be 100 and the minimum value shall be 0 with the resolution of 1 000 levels. The accuracy of the sensor is 0.05, the offset of sensor is 0.

```
<cidl:SensorDeviceCapability     xsi:type="scdv:SpeedSensorCapabilityType"
id="SS001" maxValue="100" minValue="0" numOfLevels="1000" offset="0.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.05"/>
</cidl:SensorDeviceCapability>
```

6.36 Vehicle speed sensor capability type

6.36.1 General

This subclause specifies a capability of the vehicle speed sensor. The vehicle speed sensor capability type is defined as an extension of the speed sensor capability type.

6.36.2 XML representation syntax

```
<complexType name="VehicleSpeedSensorCapabilityType">
   <complexContent>
      <extension base="scdv:SpeedSensorCapabilityType"/>
   </complexContent>
</complexType>
```

6.36.3 Binary representation syntax

VehicleSpeedSensorCapabilityType {	**Number of bits**	**Mnemonic**
SpeedSensorCapability		SpeedSensorCapabilityType
}		

6.36.4 Semantics

Semantics of the `VehicleSpeedSensorCapabilityType`.

Name	**Definition**
`VehicleSpeedSensorCapabilityType`	Tool for describing the capability of a vehicle speed sensor.

6.36.5 Examples

This example shows the description of a vehicle speed sensor capability with the following semantics. The sensor has an ID of "VSS001" and the maximum value shall be 300 and the minimum value shall be 0 with the resolution of 3 000 levels. The accuracy of the sensor is 0.05, the offset of sensor is 0.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:VehicleSpeedSensorCapabilityType"                id="VSS001"
maxValue="300" minValue="0" numOfLevels="3000" offset="0.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.05"/>
</cidl:SensorDeviceCapability>
```

6.37 Mass air flow sensor capability type

6.37.1 General

This subclause specifies the capability of a mass air flow sensor.

6.37.2 XML representation syntax

```
<complexType name="MassAirFlowSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.37.3 Binary representation syntax

MassAirFlowSensorCapabilityType {	Number of bits	Mnemonic
SensorCapability		SensorCapabilityBaseType
}		

6.37.4 Semantics

Semantics of the `MassAirFlowSensorCapabilityType`.

Name	Definition
`MassAirFlowSensorCapabilityType`	Tool for describing capability of a mass air flow sensor.

6.37.5 Examples

This example shows the description of a mass air flow sensor capability with the following semantics. The sensor has an ID of "MAIS001" and the maximum value shall be 1 000 and the minimum value shall be 0 with the resolution of 1 000 levels. The accuracy of the sensor is 0.5, the offset of sensor is 0.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:MassAirFlowSensorCapabilityType" id="MAIS001"
maxValue="1000" minValue="0" numOfLevels="1000" offset="0.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.5"/>
</cidl:SensorDeviceCapability>
```

6.38 Fuel level sensor capability type

6.38.1 General

This subclause specifies the capability of a fuel level sensor.

6.38.2 XML representation syntax

```
<complexType name="FuelLevelSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.38.3 Binary representation syntax

FuelLevelSensorCapabilityType {	Number of bits	Mnemonic
SensorCapability		SensorCapabilityBaseType
}		

6.38.4 Semantics

Semantics of the `FuelLevelSensorCapabilityType`.

Name	Definition
FuelLevelSensorType	Tool for describing the capability of a fuel level sensor, which gives vales in percentage.

6.38.5 Examples

This example shows the description of a fuel level sensor capability with the following semantics. The sensor has an ID of "FLS001" and the maximum value shall be 100 and the minimum value shall be 0 with the resolution of 100 levels. The accuracy of the sensor is 0.5, the offset of sensor is 0.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:FuelLevelSensorCapabilityType"  id="FLS001" maxValue="100"
minValue="0" numOfLevels="100" offset="0.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.5"/>
</cidl:SensorDeviceCapability>
```

6.39 Manifold absolute pressure sensor capability type

6.39.1 General

This subclause specifies the capability of a manifold absolute pressure sensor.

6.39.2 XML representation syntax

```
<complexType name="ManifoldAbsolutePressureSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.39.3 Binary representation syntax

ManifoldAbsolutePressureSensorCapabilityType {	Number of bits	Mnemonic
SensorCapability		SensorCapabilityBaseType
}		

6.39.4 Semantics

Semantics of the ManifoldAbsolutePressureSensorCapabilityType.

Name	Definition
ManifoldAbsolutePressure SensorCapabilityType	Tool for describing the capability of a manifold absolute pressure sensor.

6.39.5 Examples

This example shows the description of a manifold absolute pressure sensor capability with the following semantics. The sensor has an ID of "MAPS001" and the maximum value shall be 1 000 and the

minimum value shall be 0 with the resolution of 1 000 levels. The accuracy of the sensor is 0.5, the offset of sensor is 0.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:ManifoldAbsolutePressureSensorCapabilityType"  id="MAPS001"
maxValue="1000" minValue="0" numOfLevels="1000" offset="0.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.5"/>
</cidl:SensorDeviceCapability>
```

6.40 EngineRPM sensor capability type

6.40.1 General

This subclause specifies the capability of an engine rpm sensor.

6.40.2 XML representation syntax

```
<complexType name="EngineRPMSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType"/>
   </complexContent>
</complexType>
```

6.40.3 Binary representation syntax

EngineRPMSensorCapabilityType {	**Number of bits**	**Mnemonic**
SensorCapability		SensorCapabilityBaseType
}		

6.40.4 Semantics

Semantics of the `EngineRPMSensorCapabilityType`.

Name	**Definition**
`EngineRPMSensorCapabilityType`	Tool for describing the capability of an engine rpm sensor.

6.40.5 Examples

This example shows the description of a engine RPM sensor capability with the following semantics. The sensor has an ID of "ERPMS001" and the maximum value shall be 10 000 and the minimum value shall be 0 with the resolution of 10 000 levels. The accuracy of the sensor is 0.5, the offset of sensor is 0.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:EngineRPMSensorCapabilityType" id="ERPMS001"
maxValue="10000" minValue="0" numOfLevels="10000" offset="0.0">
   <cidl:Accuracy xsi:type="cidl:ValueAccuracy" value="0.5"/>
</cidl:SensorDeviceCapability>
```

6.41 Radar sensor capability type

6.41.1 General

This subclause specifies a sensor capability type which describes the capability about the moving or stationary target by continuously observing relative speed, angle of arrival and distance for surrounding objects for the radar sensor.

6.41.2 XML representation syntax

```
<complexType name="RadarSensorCapabilityType">
  <complexContent>
    <extension base="cidl:SensorCapabilityBaseType">
      <sequence>
        <element name="DistanceCapability">
          <complexType>
            <complexContent>
               <extension base="cidl:SensorCapabilityBaseType"/>
            </complexContent>
          </complexType>
        </element>
         <element name="OrientationCapability">
          <complexType>
            <complexContent>
              <extension base="cidl:SensorCapabilityBaseType"/>
            </complexContent>
          </complexType>
         </element>
         <element name="RelativeSpeedCapability">
          <complexType>
             <complexContent>
               <extension base="cidl:SensorCapabilityBaseType"/>
             </complexContent>
           </complexType>
          </element>
       </sequence>
      </extension>
   </complexContent>
 </complexType>
```

6.41.3 Binary representation syntax

RADARSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBaseType		**SensorCapabilityBaseType**
DistanceCapability {		
SensorCapabilityBaseType		**SensorCapabilityBaseType**
}		
OrientationCapability {		

SensorCapabilityBaseType		**SensorCapabilityBaseType**
}		
RelativeSpeedCapability {		
SensorCapabilityBaseType		**SensorCapabilityBaseType**
}		
}		

6.41.4 Semantics

Semantics of the `RadarSensorCapabilityType`.

Name	Definition
`RadarSensorCapabilityType`	Tool for describing a Radar sensor capability.
`DistanceCapability`	Describes the capability of the effective distance for detecting an object with the Radar sensor.
`OrientationCapability`	Describes the capability of the effective orientation for detecting an object with the Radar sensor.
`RelativeSpeedCapability`	Describes the capability of the effective relative speed for detecting an object with the Radar sensor.
`sensorCapabilityBaseAttributes`	There are `sensorCapabilityBaseAttributes` inherited from the `ProximitySensorCapabilityType` at the top level of the `RadarSensorCapabilityType` as well as at each individual capability description of angle of arrival, relative speed. In this capability description, the attributes defined in the `sensorCapabilityBaseAttributes` of each level are used for describing distance, angle of arrival, and relative speed capability respectively with min-max value and its unit information.

6.41.5 Examples

This example shows the description of a radar sensor capability with the following semantics. The sensor capability has an ID of "RSCT001". The sensor can measure the distance to the object between 0.5 ~ 500 metres. Angle of arrival information of detected object can be provided between 0 degree and 100 degree. Relative speed information of the detected object by radar sensor can be provided between –250 km/h and 250 km/h.

```
<cidl:SensorDeviceCapability xsi:type="RadarSensorCapabilityType"
id="RSCT001">
      <scdv:DistanceCapability maxValue="500" minValue="0.5"
unit="meter"/>
      <scdv:OrientationCapability maxValue="100" minValue="0"
unit="degree"/>
```

```
      <scdv:RelativeSpeedCapability maxValue="250" minValue="-250"
unit="kmperhour"/>
</cidl:SensoryDeviceCapability>
```

6.42 Array camera sensor capability type

6.42.1 General

This subclause specifies a sensor capability type which describes the capability about the array camera. The array camera capability type is defined as an extension of Sensor Capability Base type, and specify the sensing capabilities for each camera sensor.

6.42.2 XML representation syntax

```
<complexType name="ArrayCameraSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="NumberOfCameraCapability">
               <complexType>
                  <complexContent>
                     <extension base="cidl:SensorCapabilityBaseType"/>
                  </complexContent>
               </complexType>
            </element>
            <element name="CameraCapability" maxOccurs="unbounded">
               <complexType>
                  <complexContent>
                     <extension base="scdv:CameraSensorCapabilityType">
                        <sequence>
                           <element name="AccessPoint" type="anyURI"
minOccurs="0"/>
                        </sequence>
                     </extension>
                  </complexContent>
               </complexType>
            </element>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```


6.42.3 Binary representation syntax

ArrayCameraSensorCapabilityType {	Number of bits	Mnemonic
SensorCapabilityBaseType		SensorCapabilityBaseType
NumberOfCameraCapability {		
SensorCapabilityBaseType		SensorCapabilityBaseType
}		

ArrayCameraSensorCapabilityType {	**Number of bits**	**Mnemonic**
CameraCapability {		
CameraSensorCapabilityBaseType		CameraSensorCapabilityBaseType
AccessPoint		anyURI
}		
}		

6.42.4 Semantics

Semantics of the `ArrayCameraSensorCapabilityType`.

Name	**Definition**
`ArrayCameraSensorCapabilityType`	Tool for describing the capability of array camera sensor.
`NumberOfCameraCapability`	Describes the capability about the available number of camera sensors.
`CameraCapability`	Describes the individual camera sensor's capability.
`AccessPoint`	Describes the access point which is used for acquiring raw contents of the camera sensor, such as an image or stream of video.
`sensorCapabilityBaseAttributes`	There are `sensorCapabilityBaseAttributes` inherited from the `SensorCapabilityBaseType` at the top level of the `ArrayCameraSensorCapabilityType` as well as at each individual capability description of number of camera. In this capability description, the attributes defined in the `sensorCapabilityBaseAttributes` of the top level are disabled and not used except the `id` and `sensorIdRef` attributes.

6.42.5 Examples

This example shows the description of an array camera sensor capability with the following semantics. The sensor capability has an ID of "ACSCT001". The array camera has four sub-cameras, each of which has an access point to retrieve raw content from the camera.

```
<cidl:SensorDeviceCapability
xsi:type="scdv:ArrayCameraSensorCapabilityType" id="ACSCT001">
      <scdv:NumberOfCameraCapability maxValue="4" minValue="0"/>
      <scdv:CameraCapability id="CC000">
       <scdv:AccessPoint>http://vpv.keti.re.kr/C000</scdv:AccessPoint>
      </scdv:CameraCapability>
      <scdv:CameraCapability id="CC001">
```

```
      <scdv:AccessPoint>http://vpv.keti.re.kr/C001</scdv:AccessPoint>
     </scdv:CameraCapability>
     <scdv:CameraCapability id="CC002">
      <scdv:AccessPoint>http://vpv.keti.re.kr/C002</scdv:AccessPoint>
     </scdv:CameraCapability>
     <scdv:CameraCapability id="CC003">
      <scdv:AccessPoint>http://vpv.keti.re.kr/C003</scdv:AccessPoint>
     </scdv:CameraCapability>
</cidl:SensoryDeviceCapabilityList>
```

6.43 E-Nose sensor capability type

6.43.1 General

This subclause specifies syntax and semantics of capabilities for E-Nose. E-Nose recognizing a scent is aggregation of sensors for sensing temperature, humidity, and chemical components. In particular, the number of sensors making up the sensor array for E-Nose depends on manufacturer. E-NoseCapabilityType primarily describes capabilities related to operation of E-Nose. EnoseSensorType of EnoseSensorCapabilityType describes capabilities of individual E-nose sensor sensing particular chemical components.

6.43.2 XML representation syntax

```
<!-- ################################################ -->
<!--  E-nose sensor capability type  -->
<!-- ################################################ -->
<complexType name="EnoseSensorCapabilityType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <sequence>
            <element name="EnoseSensors" type="scdv:EnoseSensorType"
minOccurs="0" maxOccurs="unbounded"/>
            <element name="recognitionScents"
type="mpeg7:termReferenceType" minOccurs="0"  maxOccurs="unbounded"/>
         </sequence>
         <attribute name="measurementUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="tempUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="warmupTime" type="nonNegativeInteger"
use="optional"/>
         <attribute name="recognitionTime" type="nonNegativeInteger"
use="optional"/>
         <attribute name="numOfRecognitionScents"
type="nonNegativeInteger" use="optional"/>
         <attribute name="maxOperatingTemp" type="nonNegativeInteger"
use="optional"/>
         <attribute name="minOperatingTemp" type="nonNegativeInteger"
use="optional"/>
         <attribute name="maxOperatingHumid" type="nonNegativeInteger"
use="optional"/>
            <attribute name="numOfEnoseSensors" type="nonNegativeInteger"
use="optional"/>
      </extension>
   </complexContent>
```

```
</complexType>

<complexType name="EnoseSensorType">
   <complexContent>
      <extension base="cidl:SensorCapabilityBaseType">
         <attribute name="EnoseSensorTechnology"
type="mpeg7:termReferenceType" use="optional"/>
         <attribute name="TargetGas" type="mpeg7:termReferenceType"
use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.43.3 Binary representation syntax

EnoseSensorCapabilityType {	Number of bits	Mnemonic
EnoseSensorsFlag	1	bslbf
measurementUnitFlag	1	bslbf
tempUnitFlag	1	bslbf
warmupTimeFlag	1	bslbf
recognitionTimeFlag	1	bslbf
numOfRecognitionScentsFlag	1	bslbf
maxOperatingTempFlag	1	bslbf
minOperatingTempFlag	1	bslbf
maxOperatingHumidFlag	1	bslbf
recognitionScentsFlag	1	bslbf
numOfEnoseSensorsFlag	1	bslbf
SensorCapability		SensorCapabilityBaseType
if(EnoseSensorsFlag) {		
LoopEnoseSensors	8	bslbf
for(k=0; k<LoopEnoseSensors; k++) {		
EnoseSensors[k]		EnoseSensorType
}		
}		

EnoseSensorCapabilityType {	Number of bits	Mnemonic
if(measurementUnitFlag) {		
measurementUnit	8	bslbf
}		
if(tempUnitFlag) {		
tempUnit	8	bslbf
}		
if(warmupTimeFlag) {		
warmupTime	12	uimsbf
}		
if(recognitionTimeFlag) {		
recognitionTime	12	uimsbf
}		
if(numOfRecognitionScentsFlag) {		
numOfRecognitionScents	8	uimsbf
}		
if(maxOperatingTempFlag) {		
maxOperatingTemp	6	uimsbf
}		
if(minOperatingTempFlag) {		
minOperatingTemp	6	uimsbf
}		
if(maxOperatingHumidFlag) {		
maxOperatingHumid	7	uimsbf
}		
if(recognitionScentsFlag) {		
LooprecognitionScents	8	uimsbf

EnoseSensorCapabilityType {	Number of bits	Mnemonic
for(k=0; k<LooprecognitionScents; k++) {		
recognitionScents[k]	9	bslbf
}		
}		
if(numOfEnoseSensorsFlag){		
numOfEnoseSensors	8	uimsbf
}		
}		
EnoseSensorType{		
EnoseSensorTechnologyFlag	1	bslbf
TargetGasFlag	1	bslbf
SensorCapability		SensorCapabilityBaseType
if(EnoseSensorTechnologyFlag){		
EnoseSensorTechnology	4	uimsbf
}		
if(TargetGasFlag){		
TargetGas	16	uimsbf
}		
}		

6.43.4 Semantics

Semantics of the `EnoseSensorCapabilityType`.

Name	Definition
EnoseSensorCapabilityType	Tool for describing E-Nose capability.
EnoseSensorsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
measurementUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
tempUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
warmupTimeFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
recognitionTimeFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfRecognitionScentsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxOperatingTempFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
minOperatingTempFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxOperatingHumidFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
recognitionScentsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
numOfEnoseSensorsFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
EnoseSensors	Tool for describing a capability of individual sensors in E-Nose contained in the description.
measurementUnit	Specifies the unit of measurement of E-nose as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1, if any unit other than the default unit of ppm is used. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
tempUnit	Specifies the unit of the description of maxOperatingTemp and minOperatingTemp as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1, if any unit other than the default unit of Celsius is used. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
warmupTime	Describes the warming-up time in term of SEC that have to be performed after power switch-on of E-Nose.
recognitionTime	Describes the recognition time in term of SEC that is needed to recognize scents (or odors).
numOfRecognitionScents	Describes the number of recognizable scents that can be recognized through E-Nose.
recognitionScents	Describes the list of scents that E-Nose can recognize. The type of the scent shall be described using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. A CS that may be used for this purpose is the ScentCS defined in ISO/IEC 23005-6: —, A.2.4.
maxOperatingTemp	Describes the maximum temperature for the stable performance of E-Nose in term of Celsius.

Name	Definition
minOperatingTemp	Describes the minimum temperature for the stable performance of E-Nose in term of Celsius.
maxOperatingHumid	Describes the maximum humidity for the stable performance of E-Nose in term of relative humidity %.
numOfEnoseSensors	Describes the number of sensors which make up the sensor array for E-Nose.

Semantics of the EnoseSensorType.

Name	Definition
EnoseSensorType	Tool for describing a capability of individual sensors in E-Nose.
EnoseSensorTechnologyFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
TargetGasFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
EnoseSensorTechnology	Describes the technology of E-Nose sensor. Tool for describing the technology of E-Nose sensor as a reference to a classification scheme term provided by EnoseSensorTechnologyCS defined in ISO/IEC 23005-6: —, A.2.12.13. The details of the structure and use of classification scheme and termReferencetype description is defined in ISO/IEC 15938-5:2003, 7.6.
TargetGas	Describes the target gas of E-Nose sensor which is a component of sensor array in E-Nose device. Tool for describing the target gas type as a reference to a classification scheme term provided by GasTypeCS defined in ISO/IEC 23005-6: —, A.2.12.8. The details of the structure and use of classification scheme and termReferenceType description is defined in ISO/IEC 15938-5:2003, 7.6.

6.43.5 Examples

This example shows the description of an E-nose sensing capability with the following semantics. The E-nose has an ID of "Enose_01" and is comprised of two sensors. One is a VOC sensor of MOS type and has a measuring range from 10 to 5 000 ppm. The other is an ethanol sensor of MOS type and has a measuring range from 1 to 1 000 ppm. The warm-up and recognition time of this device are 600 and

30 seconds. The allowable temperature range is 5 °C ~60 °C. The allowable humidity range is below 70 %. And, this E-nose system can recognize three odors (e.g., apple, rose and orange).

```
<cidl:SensorDeviceCapability     xsi:type="scdv:EnoseSensorCapabilityType"
id="Enose_01"  measurementUnit="ppm"  tempUnit="celsius"  warmupTime="600"
recognitionTime="30"    numOfRecognitionScents="3"    maxOperatingTemp="60"
minOperatingTemp="5" maxOperatingHumid="70" numOfEnoseSensors="2">
   <scdv:EnoseSensors        EnoseSensorTechnology="urn:mpeg:mpeg-v:01-CI-
EnoseSensorTechnologyCS-NS:MOS_sensor"   TargetGas="urn:mpeg:mpeg-v:01-CI-
GasCS-NS:VOC" maxValue="5000.0" minValue="10.0" unit="ppm"/>
   <scdv:EnoseSensors        EnoseSensorTechnology="urn:mpeg:mpeg-v:01-CI-
EnoseSensorTechnologyCS-NS:MOS_sensor"   TargetGas="urn:mpeg:mpeg-v:01-CI-
GasCS-NS:ethanol" maxValue="1000.0" minValue="1.0" unit="ppm"/>
   <scdv:recognitionScents>urn:mpeg:mpeg-v:01-SI-ScentCS-
NS:apple</scdv:recognitionScents>
   <scdv:recognitionScents>urn:mpeg:mpeg-v:01-SI-ScentCS-
NS:rose</scdv:recognitionScents>
   <scdv:recognitionScents>urn:mpeg:mpeg-v:01-SI-ScentCS-
NS:orange</scdv:recognitionScents>
</cidl:SensorDeviceCapability>
```

6.44 Microphone sensor capability type

6.44.1 General

This subclause specifies syntax and semantics of capability description for a microphone sensor.

6.44.2 Syntax

```
<complexType name="MicrophoneSensorCapabilityType">
  <complexContent>
    <extension base="cidl:SensorCapabilityBaseType">
      <sequence>
       <element name="micorphoneType” type="scdv:mcrophoneListType"
minOccurs="0"/>
       <element name="transcuderArrayType"
type="scdv:transducerArrayListType" minOccurs="0"/>
       <element name="probtType" type="scdv:probeListType" minOccurs="0"/>
       <element name="polarPatternType" type="scdv:polarPatternListType"
minOccurs="0"/>
       <element name="frequencyRange" type="scdv:frequencyRangeType"
minOccurs="0"/>
       <element name="responseType" type="scdv:frequencyRangeType"
minOccurs="0"/>
       <element name="pickSensitivity" type="float" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

<simpleType name="microphoneListType">
   <restriction base="string">
       <enumeration value="condenser"/>
       <enumeration value="dynamic"/>
```

```
        <enumeration value="ribbon"/>
        <enumeration value="carbon"/>
        <enumeration value="piezoelectric"/>
        <enumeration value="fiber optic"/>
        <enumeration value="laser"/>
        <enumeration value="liquied"/>
        <enumeration value="MEMS"/>
    </restriction>
</simpleType>

<simpleType name="transducerArrayListType">
    <restriction base="string">
        <enumeration value="single array"/>
        <enumeration value="linear array"/>
        <enumeration value="curvilinear"/>
        <enumeration value="phased"/>
        <enumeration value="annular"/>
        <enumeration value="matrix array"/>
        <enumeration value="MEMS"/>
    </restriction>
</simpleType>

<simpleType name="probeListType">
    <restriction base="string">
        <enumeration value="linear"/>
        <enumeration value="sector"/>
        <enumeration value="convex"/>
        <enumeration value="carbon"/>
        <enumeration value="trapezoid"/>
    </restriction>
</simpleType>

<simpleType name="polarPatternListType">
    <restriction base="string">
        <enumeration value="omnidirectional"/>
        <enumeration value="bi-directional"/>
        <enumeration value="subcardioid"/>
        <enumeration value="cardioid"/>
        <enumeration value="hypercardioid"/>
        <enumeration value="supercardioid"/>
        <enumeration value="shotgun"/>
    </restriction>
</simpleType>

<complexType name="frequencyRangeType">
    <sequence>
        <element name="minFrequency" type="float"/>
        <element name="maxFrequency" type="float"/>
    </sequence>
</complexType>
```

6.44.3 Binary reprentation syntax

MicrophoneSensorCapabilityType{	Number of bits	Mnemonic
microphoneTypeFlag	1	bslbf
transducerArrayFlag	1	bslbf
probeTypeFlag	1	bslbf
polarPatternTypeFlag	1	bslbf
frequencyRangeFlag	1	bslbf
frequencyResponseTypeFlag	1	bslbf
sensitivityFlag	1	bslbf
SensorCapabilityBase		SensorCapabilityBaseType
if (microphoneTypeFlag == 1){		
microphoneType		microphoneListType
}		
if (transducerArrayFlag == 1){		
transducerArrayType		trnasducerArrayListType
}		
if (probeTypeFlag == 1){		
probeType	4	probeListType
}		
if (polarPatternTypeFlag == 1){		
polarPattern	4	polarPatternListType
}		
if (frequencyRangeFlag == 1){		
frequencyRange		frequencyRangeType
}		
if (responseTypeFlag == 1){		

MicrophoneSensorCapabilityType{	**Number of bits**	**Mnemonic**
responseFrequency		frequencyRangeType
}		
if (sensitivityFlag == 1){		
pickSensitivity	32	fsbf
}		
microphoneListType {		
microphoneType	4	bslbf
}		
transducerArrayListType {		
transducerArrayType	4	blsbf
}		
probeListType {		
probeType	4	blsbf
}		
polarPatternListyType {		
polarPattern	4	blsbf
}		
frequencyRangeType {		
minFrequency	32	uimsbf
maxFrequency	32	uimsbf

MicrophoneSensorCapabilityType{	**Number of bits**	**Mnemonic**
}		

6.44.4 Semantics

Semantics of the `MicrophoneSensorCapabilityType`.

Name	**Definition**

`microphoneType`	Defines type of microphone
	`0000 Reserved`
	`0001 Condenser`
	`0010 Dynamic`
	`0011 Ribbon`
	`0100 Carbon`
	`0101 Piezoelectric`
	`0110 Fiber Optic`
	`0111 Laser`
	`1000 Liquid`
	`1001 MEMS`
	`1010-1111 Reserved`

`transducerArrayType`	Defines array types of transducer probes
	`0000 Reserved`
	`0001 single array`
	`0010 linear array`
	`0011 curvilinear`
	`0100 phased`
	`0101 annular`
	`0110 matrix array`
	`0111-1111 Reserved`

Name	Definition
probeType	Defines probing type of transducer 0000 Reserved 0001 linear probe 0010 sector probe 0011 convex probe 0100 trapezoid probe 0101-1111 Reserved
polarPattern	Defines polar pattern of transducer 0000 Reserved 0001 Omnidirectional 0010 Bi-directional (or Figure of 8) 0011 Subcardioid 0100 Cardioid 0101 Hypercardioid 0110 Supercardioid 0111 Shotgun 1000-1111 Reserved
frequencyRange	Pickup frequency range in Hz
responseTypeFlag	'0' if Flat frequency response '1' if Tailored frequency response
responseFrequency	Pick response frequency range for tailored frequency response microphone
minFreqeuncy	Minimum frequency in Hz
maxFrequency	Maximum frequency in Hz
pickSensitivity	Pick sensitivity of transducer in mV/Pa

6.44.5 Examples

This example shows the description of a microphone capability with the following semantics. The microphone has an ID of "MCID_001". It is a condenser microphone with cardioid pattern of which the frequency picks up range is 20 HZ to 20 kHz tailored between 20 HZ to 8 kHz.

```
<cidl:SensorDeviceCapability      xsi:type="scdv:microphoneCapabilityType"
id="MCID_001">
   <microphoneType>"condenser"</microphoneType>
   <polarPatternType>"cardioid"</polarPatternType>
   <scdv:frequencyRange>
      <scdv:minFrequency>20</scdv:minFrequency>
      <scdv:maxFrequency>20000</scdv:maxFrequency>
   </scdv:frequencyRange>
   <scdv:responseType>
      <scdv:minFrequency>20</scdv:minFrequency >
      <scdv:maxFrequency >8000</scdv:maxFrequency >
   </scdv:responseType>
</cidl:SensorDeviceCapability>
```

7 User's sensory preference vocabulary

7.1 General

This Clause describes syntax and semantics of the user's sensory preference vocabulary which comprises the following effects:

— light, coloured light, flash;

— heating, cooling;

— wind;

— vibration;

— scent;

— fog;

— sprayer;

— colour correction;

— tactile;

— kinesthetic;

— rigid body motion;

— bubble;

— 3D printing;

— 3D printing colour reproduction;

— arrayed light;

— sound diplay.

NOTE SEPV has been designed in an extensible way and additional user preferences on sensory effects can be added easily.

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:2018:01-CT-NS" xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS"
xmlns:sepv="urn:mpeg:mpeg-v:2018:01-SEPV-NS"
targetNamespace="urn:mpeg:mpeg-v:2018:01-SEPV-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-2" 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:2018:01-CIDL-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/CIDL.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2018:01-CT-NS"
schemalocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/
MPEG-V_schema_files/MPEG-V-CT.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 General

This subclause specifies syntax and semantics of user's preferences towards light or coloured light effects.

7.3.2 XML representation syntax

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

7.3.3 Binary representation syntax

LightPrefType {	Number of bits	Mnemonic
UnfavorableColorFlag	1	bslbf
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(UnfavorableColorFlag){		
LoopUnfavorableColor		vluimsbf5
for(k=0;k< LoopUnfavorableColor;k++){		
UnfavorableColor[k]		ColorType
}		
}		
if(maxIntensityFlag){		
maxIntensity	32	fsbf
}		
if(unitFlag){		
Unit	8	bslbf
}		
}		

7.3.4 Semantics

Semantics of the `LightPrefType` type.

Name	Definition
`LightPrefType`	Tool for describing a user preference on light effect.
`UnfavorableColorFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
unitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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 ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.
UnfavorableColor	Describes the list of user's detestable colours 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 ISO/IEC 23005-6: —, A.2.2. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6. EXAMPLE urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue would describe the colour Alice blue.

7.3.5 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 colour, which is refused by user, is "alice_blue" from the classification scheme described in ISO/IEC 23005-6: —, A.2.2.

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

7.4 Flash preference type

7.4.1 General

This subclause specifies syntax and semantics of user's preferences towards flash effects.

7.4.2 XML representation syntax

```
<complexType name="FlashPrefType">
   <complexContent>
      <extension base="sepv:LightPrefType">
         <attribute name="maxFrequency" type="float" use="optional"/>
         <attribute name="freqUnit" type="mpegvct:unitType"
use="optional"/>
      </extension>
   </complexContent>
```

```
</complexType>
```

7.4.3 Binary representation syntax

FlashPrefType {	Number of bits	Mnemonic
maxFrequencyFlag	1	bslbf
freqUnitFlag	1	bslbf
LightPref		LightPrefType
if(maxFrequencyFlag){		
maxFrequency	32	fsbf
}		
if(freqUnitFlag){		
freqUnit	8	bslbf
}		
}		

7.4.4 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.
`maxFrequencyFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`freqUnitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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 ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.

7.4.5 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:USPreference xsi:type="sepv:FlashPrefType" activate="true"
maxFrequency="50" unit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:Hz"/>
```

7.5 Heating preference type

7.5.1 General

This subclause specifies syntax and semantics of user's preferences towards temperature (i.e., heating) effects.

7.5.2 XML representation syntax

```
<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>
```

7.5.3 Binary representation syntax

HeatingPrefType {	Number of bits	Mnemonic
minIntensityFlag	1	bslbf
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(minIntensityFlag){		
minIntensity	8	uimsbf
}		
if(maxIntensityFlag){		
maxIntensity	16	uimsbf
}		
if(unitFlag){		
unit	8	bslbf
}		

HeatingPrefType {	Number of bits	Mnemonic
}		

7.5.4 Semantics

Semantics of the `HeatingPrefType` type.

Name	Definition
`HeatingPrefType`	Tool for describing a user preference on heating effect.
`minIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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 ISO/IEC 23005-6: —, A.2.1. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in ISO/IEC 15938-5:2003, 7.6.

7.5.5 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 °C, and minimum intensity of 20 °C. When the given command on the heating effect is not within the range of preference or capability, it should be properly scaled.

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

7.6 Cooling preference type

7.6.1 General

This subclause specifies syntax and semantics of user's preferences towards temperature (i.e., cooling) effects.

7.6.2 XML representation syntax

```
<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>
```

7.6.3 Binary representation syntax

CoolingPrefType {	Number of bits	Mnemonic
minIntensityFlag	1	bslbf
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(minIntensityFlag){		
minIntensity	16	simsbf
}		
if(maxIntensityFlag){		
maxIntensity	16	simsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
}		

7.6.4 Semantics

Semantics of the `CoolingPrefType` type.

Name	Definition
`CoolingPrefType`	Tool for describing a user preference on cooling effect.
`minIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be

Name	Definition
	used and "0" means the attribute shall not be used.
maxIntensityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
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 ISO/IEC 23005-6: —, A.2.1. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.

7.6.5 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 °C, and minimum intensity of 30 °C. When the given command on the cooling effect is not within the range of preference or capability, it should be properly scaled.

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

7.7 Wind preference type

7.7.1 General

This subclause specifies syntax and semantics of user's preferences towards wind effects.

7.7.2 XML representation syntax

```
<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>
```

7.7.3 Binary representation syntax

WindPrefType {	Number of bits	Mnemonic
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(maxIntensityFlag){		
maxIntensity	16	simsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
}		

7.7.4 Semantics

Semantics of the `WindPrefType` type.

Name	Definition
`WindPrefType`	Tool for describing a user preference on a wind effect.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`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 ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.

7.7.5 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.

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

7.8 Vibration preference type

7.8.1 General

This subclause specifies syntax and semantics of user's preferences towards vibration effects.

7.8.2 XML representation syntax

```
<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>
```

7.8.3 Binary representation syntax

VibrationPrefType {	Number of bits	Mnemonic
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(maxIntensityFlag){		
maxIntensity	16	simsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
}		

7.8.4 Semantics

Semantics of the `VibrationPrefType` type.

Name	Definition
VibrationPrefType	Tool for describing a user preference on vibration effect.
maxIntensityFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
unitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxIntensity	Describes the maximum desirable intensity of the vibration effect in terms of strength with respect to Hertz.
unit	Specifies the unit of the maxIntensity value as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.

7.8.5 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 600 Hz. 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 600 Hz, if the maximum intensity defined in the device capability is greater than 600.

```
<cidl:USPreference xsi:type="sepv:VibrationPrefType" id="vibe02"
maxIntensity="600" activate="true" adaptationMode="scalable"/>
```

7.9 Scent preference type

7.9.1 General

This subclause specifies syntax and semantics of user's preferences towards scent effects.

7.9.2 XML representation syntax

```
<complexType name="ScentPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <sequence>
            <element name="HedonicScent" 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>
```

7.9.3 Binary representation syntax

ScentPrefType {	Number of bits	Mnemonic
HedonicScentFlag	1	bslbf
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(HedonicScentFlag){		
LoopHedonicScent		vluimsbf5
for(k=0;k< LoopHedonicScent;k++){		
HedonicScent[k]	9	blsbf
}		
}		
if(maxIntensityFlag){		
maxIntensity	16	simsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
}		

7.9.4 Semantics

Semantics of the `ScentPrefType` type.

Name	Definition
`ScentPrefType`	Tool for describing a user preference on scent effect.
`HedonicScentFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
unitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
LoopHedonicScent	This field, which is only present in the binary representation, specifies the number of HedonicScent contained in the description.
HedonicScent	Describes the list of user's pleasant or unpleasant scent. A CS that may be used for this purpose is the ScentCS defined in ISO/IEC 23005-6: —, A.2.4. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
maxIntensity	Describes the maximum desirable intensity of the scent effect in terms of millilitre/hour.
unit	Specifies the unit of the maxIntensity value as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.

7.9.5 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 millilitre/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 millilitre/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.

```
<cidl:USPreference xsi:type="sepv:ScentPrefType" id="scent001"
maxIntensity="4" adaptationMode="scalable">
  <sepv:HedonicScent>
  urn:mpeg:mpeg-v:01-SI-ScentCS-NS:rose
  </sepv:HedonicScent>
</cidl:USPreference>
```

7.10 Fog preference type

7.10.1 General

This subclause specifies syntax and semantics of user's preferences towards fog effects.

7.10.2 XML representation syntax

```
<complexType name="FogPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <attribute name="maxIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
```

```
    </complexContent>
</complexType>
```

7.10.3 Binary representation syntax

FogPrefType {	Number of bits	Mnemonic
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(maxIntensityFlag){		
maxIntensity	16	simsbf
}		
if(unitFlag){		
unit	8	bslbf
}		
}		

7.10.4 Semantics

Semantics of the `FogPrefType` type.

Name	Definition
`FogPrefType`	Tool for describing a preference on fog effect.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxIntensity`	Describes the maximum desirable intensity of the fog effect in terms of millilitre/hour.
`unit`	Specifies the unit of the `maxIntensity` value as a reference to a classification scheme term provided by `UnitTypeCS` defined in ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.

7.10.5 Examples

This example shows a description of a user preference on fog effect with the following semantics. The identifier for this preference description is “fogfog”. The fog effect is desired with the maximum intensity of upto 5 millilitre/hour. When the given command on the fog effect is not within the range of preference or capability, it should be properly scaled with the maximum of 5 millilitre/hour, if the maximum intensity defined in the device capability is greater than 5.

```
<cidl:USPreference xsi:type="sepv:FogPrefType" id="fogfog"
maxIntensity="5"
adaptationMode="scalable"/>
```

7.11 Spraying preference type

7.11.1 General

This subclause specifies syntax and semantics of user’s preferences towards sprayer effects.

7.11.2 XML representation syntax

```
<complexType name="SprayingPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <attribute name="sprayingType" type="mpeg7:termReferenceType"/>
         <attribute name="maxIntensity" type="integer" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.11.3 Binary representation syntax

SprayingPrefType{	Number of bits	Mnemonic
sprayingFlag	1	bslbf
maxIntensityFlag	1	bslbf
unitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(sprayingFlag){		
spraying		SprayingType
}		
if(maxIntensityFlag){		
maxIntensity	16	simsbf
}		

SprayingPrefType{	Number of bits	Mnemonic
if(unitFlag){		
unit	8	bslbf
}		
}		

7.11.4 Semantics

Semantics of the `SprayingPrefType` type.

Name	Definition
`SprayingPrefType`	Tool for describing a user preference on spraying effect.
`sprayingFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxIntensityFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`unitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`sprayingType`	Describes the type of the sprayed material as a reference to a classification scheme term. The reference to the classification scheme shall be done using the `mpeg7:termReferenceType` defined in ISO/IEC 15938-5:2003, 7.6. A CS that may be used for this purpose is the `SprayingTypeCS` defined in ISO/IEC 23005-6: —, A.2.7.
`maxIntensity`	Describes the maximum desirable intensity of the spraying effect in terms of millilitre/hour.
`unit`	Specifies the unit of the `maxIntensity` value as a reference to a classification scheme term provided by `UnitTypeCS` defined in ISO/IEC 23005-6: —, A.2.1, 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 ISO/IEC 15938-5:2003, 7.6.

7.11.5 Examples

This example shows a description of a user preference on spraying effect with the following semantics. The identifier for this preference description is "letspray". The spraying effect is desired with the maximum intensity of upto 4 millilitre/hour. When the given command on the spraying effect is not within the range of preference or capability, it should be properly scaled with the maximum of 4 millilitre/hour, if the maximum intensity defined in the device capability is greater than 4. The desired

material to be sprayed is purified water, as defined in the SprayingTypeCS defined in ISO/IEC 23005-6: —, A.2.7.

```
<cidl:USPreference xsi:type="sepv:SprayingPrefType" id="letspray"
maxIntensity="4" sprayingType="urn:mpeg:mpeg-v:01-SI-SprayingTypeCS-
NS:water"/>
```

7.12 Colour correction preference type

7.12.1 General

This subclause specifies syntax and semantics of user's preferences towards colour correction effects.

7.12.2 XML representation syntax

```
<complexType name="ColorCorrectionPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType"/>
   </complexContent>
</complexType>
```

7.12.3 Binary representation syntax

ColorCorrectionPrefType {	**Number of bits**	**Mnemonic**
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
}		

7.12.4 Semantics

Semantics of the `ColorCorrectionPreferenceType` type.

Name	**Definition**
`ColorCorrectionPrefType`	Specifies whether the user prefers to use colour correction functionality of the device or not by using `activate` attribute. Any information given by other attributes is ignored.

7.12.5 Examples

This example shows the description of a user preference on colour correction effect with the following semantics. The colour collection effect is desired by user simply by activating it "true".

```
<cidl:USPreference xsi:type="sepv:ColorCorrectionPrefType"
activate="true"/>
```

7.13 Tactile preference type

7.13.1 General

This subclause specifies syntax and semantics of user's preferences towards tactile effects.

7.13.2 XML representation syntax

```
<complexType name="TactilePrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <attribute name="maxTemperature" type="float" use="optional"/>
         <attribute name="minTemperature" type="float" use="optional"/>
         <attribute name="maxCurrent" type="float" use="optional"/>
         <attribute name="maxVibration" type="float" use="optional"/>
         <attribute name="tempUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="currentUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="vibrationUnit" type="mpegvct:unitType"
            use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.13.3 Binary representation syntax

TactilePrefType {	Number of bits	Mnemonic
maxTemperatureFlag	1	bslbf
minTemperatureFlag	1	bslbf
maxCurrentFlag	1	bslbf
maxVibrationFlag	1	bslbf
tempUnitFlag	1	bslbf
currentUnitFlag	1	bslbf
vibrationUnitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(maxTemperatureFlag){		
maxTemperature	32	fsbf
}		
if(minTemperatureFlag){		
minTemperature	32	fsbf
}		
if(maxCurrentFlag){		
maxCurrent	32	fsbf

TactilePrefType {	Number of bits	Mnemonic
}		
if(maxVibrationFlag){		
maxVibration	32	fsbf
}		
if(tempUnitFlag){		
tempUnit	8	bslbf
}		
if(currentUnitFlag){		
currentUnit	8	bslbf
}		
if(vibrationUnitFlag){		
vibrationUnit	8	bslbf
}		
}		

7.13.4 Semantics

Semantics of the `TactilePrefType`.

Name	Definition
`TactilePrefType`	Tool for describing a user preference on tactile effect.
`maxTemperatureFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`minTemperatureFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxCurrentFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`maxVibrationFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.

Name	Definition
tempUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
currentUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
vibrationUnitFlag	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
maxTemperature	Describes the maximum desirable temperature regarding how hot the tactile effect may be achieved. (Celsius)
minTemperature	Describes the minimum desirable temperature regarding how cold the tactile effect may be achieved.(Celsius)
maxCurrent	Describes the maximum desirable electric current. (mA)
maxVibration	Describes the maximum desirable vibration.(mm)
tempUnit	Specifies the unit of the intensity, as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. If the unit is not specified, the default unit is Celsius. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
currentUnit	Specifies the unit of the intensity, as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. If the unit is not specified, the default unit is milli-ampere. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
vibrationUnit	Specifies the unit of the intensity, as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.

7.13.5 Examples

An example of the TactilePrefType to indicate the preference of tactile sensory effect is given. For the case of thermal display maximum temperature is 45 degree Celsius and minimum temperature is 10 degree Celsius. Also maximum electric current less than 30 mA is preferred and maximum vibration not exceeded 0.1 mm is preferred.

```
<cidl:USPreference xsi:type="sepv:TactilePrefType" maxTemperature="45"
minTemperature="10" maxCurrent="30" maxVibration="0.1"
tempUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:celsius"
currentUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:milliampere"
vibrationUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:mm"/>
```

7.14 Kinesthetic preference type

7.14.1 General

This subclause specifies syntax and semantics of user's preferences towards kinesthetic effects.

7.14.2 XML representation syntax

```
<complexType name="KinestheticPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <sequence>
            <element name="MaxForce" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
            <element name="MaxTorque" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
         <attribute name="forceUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="torqueUnit" type="mpegvct:unitType"
use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

7.14.3 Binary representation syntax

KinestheticPrefType {	Number of bits	Mnemonic
MaxForceFlag	1	bslbf
MaxTorqueFlag	1	bslbf
forceUnitFlag	1	bslbf
torqueUnitFlag	1	bslbf
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
if(MaxForceFlag){		
MaxForce		Float3DVectorType
}		
if(MaxTorqueFlag){		
MaxTorque		Float3DVectorType
}		
if(forceUnitFlag) {		

KinestheticPrefType {	Number of bits	Mnemonic
forceUnit	8	bslbf
}		
if(torqueUnitFlag) {		
torqueUnit	8	bslbf
}		
}		
Float3DVectorType {		
X	32	fsbf
Y	32	fsbf
Z	32	fsbf
}		

7.14.4 Semantics

Semantics of the `KinestheticPrefType`.

Name	Definition
`KinestheticPrefType`	Tool for describing a user preference on Kinesthetic effect (forcefeedback effect).
`MaxForceFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`MaxTorqueFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`forceUnitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`torqueUnitFlag`	This field, which is only present in the binary representation, signals the presence of the activation attribute. A value of "1" means the attribute shall be used and "0" means the attribute shall not be used.
`MaxForce`	Describes the maximum desirable force for each direction of 3 dimensional axis (X, Y and Z). (N)
`MaxTorque`	Describes the maximum desirable torque for each direction of 3

Name	Definition
	dimensional axis (X, Y and Z). (Nmm)
forceUnit	Specifies the unit of the intensity, as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. If the unit is not specified, the default unit is Newton (N). The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.
torqueUnit	Specifies the unit of the intensity, as a reference to a classification scheme term provided by UnitTypeCS defined in ISO/IEC 23005-6: —, A.2.1. If the unit is not specified, the default unit is Newton millimetre (Nmm). The reference to the classification scheme shall be done using the mpeg7:termReferenceType defined in ISO/IEC 15938-5:2003, 7.6.

7.14.5 Examples

This example of the KinestheticPrefType indicates the preference of kinesthetic sensory effect. In this example, a maximum force is considered with values of forces on each axis (Fx = 5.0 N, Fy = 3.0 N, Fz = 3.5 N).

```
<cidl:USPreference xsi:type="sepv:KinestheticPrefType"
forceUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:Newton"
torqueUnit="urn:mpeg:mpeg-v:01-CI-UnitTypeCS-NS:Nmm">
   <sepv:MaxForce>
      <mpegvct:X>5.0</mpegvct:X>
      <mpegvct:Y>3.0</mpegvct:Y>
      <mpegvct:Z>3.5</mpegvct:Z>
   </sepv:MaxForce>
</cidl:USPreference>
```

7.15 RigidBodyMotion preference type

7.15.1 General

This subclause specifies syntax and semantics of user's preferences towards rigid body motion effects.

7.15.2 XML representation syntax

```
<complexType name="RigidBodyMotionPrefType">
   <complexContent>
      <extension base="cidl:UserSensoryPreferenceBaseType">
         <sequence maxOccurs="unbounded">
            <element name="MotionPreference"
               type="sepv:MotionPreferenceBaseType"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>

<complexType name="MotionPreferenceBaseType" abstract="true">
   <attribute name="unfavor" type="boolean" use="optional" default="0"/>
```

```
</complexType>

<complexType name="MoveTowardPreferenceType">
   <complexContent>
      <extension base="sepv:MotionPreferenceBaseType">
         <attribute name="maxMoveDistance" type="unsignedInt"
use="optional"/>
         <attribute name="maxMoveSpeed" type="float" use="optional"/>
         <attribute name="maxMoveAccel" type="float" use="optional"/>
         <attribute name="distanceUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="speedUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="accelUnit" type="mpegvct:unitType"
use="optional"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="InclinePreferenceType">
   <complexContent>
      <extension base="sepv:MotionPreferenceBaseType">
         <attribute name="maxRotationAngle" type="float" use="optional"/>
         <attribute name="maxRotationSpeed" type="float" use="optional"/>
         <attribute name="maxRotationAccel" type="float" use="optional"/>
         <attribute name="angleUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="speedUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="accelUnit" type="mpegvct:unitType"
use="optional"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="WavePreferenceType">
   <complexContent>
      <extension base="sepv:MotionPreferenceBaseType">
         <attribute name="maxWaveDistance" type="float" use="optional"/>
         <attribute name="maxWaveSpeed" type="float" use="optional"/>
         <attribute name="distanceUnit" type="mpegvct:unitType"
use="optional"/>
         <attribute name="speedUnit" type="mpegvct:unitType"
use="optional"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="CollidePreferenceType">
   <complexContent>
      <extension base="sepv:MotionPreferenceBaseType">
         <attribute name="maxCollideSpeed" type="float" use="optional"/>
         <attribute name="speedUnit" type="mpegvct:unitType"
use="optional"/>
      </extension>
```

```
    </complexContent>
</complexType>

<complexType name="TurnPreferenceType">
    <complexContent>
        <extension base="sepv:MotionPreferenceBaseType">
            <attribute name="maxTurnSpeed" type="float" use="optional"/>
            <attribute name="speedUnit" type="mpegvct:unitType"
use="optional"/>
        </extension>
    </complexContent>
</complexType>

<complexType name="ShakePreferenceType">
    <complexContent>
        <extension base="sepv:MotionPreferenceBaseType">
            <attribute name="maxShakeDistance" type="float" use="optional"/>
            <attribute name="maxShakeSpeed" type="float" use="optional"/>
            <attribute name="distanceUnit" type="mpegvct:unitType"
use="optional"/>
            <attribute name="speedUnit" type="mpegvct:unitType"
use="optional"/>
        </extension>
    </complexContent>
</complexType>

<complexType name="SpinPreferenceType">
    <complexContent>
        <extension base="sepv:MotionPreferenceBaseType">
            <attribute name="maxSpinSpeed" type="float" use="optional"/>
            <attribute name="speedUnit" type="mpegvct:unitType"
use="optional"/>
        </extension>
    </complexContent>
</complexType>
```

7.15.3 Binary representation syntax

RigidBodyMotionPrefType {	Number of bits	Mnemonic
UserSensoryPreferenceBase		UserSensoryPreferenceBaseType
LoopMotionPreference	4	uimsbf
for(k=0;k< LoopMotionPreference;k++){		
MotionPreferenceType[k]	4	bslbf
MotionPreference[k]		MotionPreferenceBaseType
}		
}		

RigidBodyMotionPrefType {	Number of bits	Mnemonic
MotionPreferenceBaseType {		
unfavorFlag	1	bslbf
if(unfavorFlag){		
unfavor	1	bslbf
}		
}		
MoveTowardPreferenceType {		
maxMoveDistanceFlag	1	bslbf
maxMoveSpeedFlag	1	bslbf
maxMoveAccelFlag	1	bslbf
distanceUnitFlag	1	bslbf
speedUnitFlag	1	bslbf
accelUnitFlag	1	bslbf
MotionPreferenceBase		MotionPreferenceBaseType
if(maxMoveDistanceFlag){		
maxMoveDistance	8	uimsbf
}		
if(maxMoveSpeedFlag){		
maxMoveSpeed	32	fsbf
}		
if(maxMoveAccelFlag){		
maxMoveAccel	32	fsbf
}		
if(distanceUnitFlag){		
distanceUnit	8	bslbf
}		

RigidBodyMotionPrefType {	Number of bits	Mnemonic
if(speedUnitFlag){		
speedUnit	8	bslbf
}		
if(accelUnitFlag){		
accelUnit	8	bslbf
}		
}		
InclinePreferenceType {		
maxRotationAngleFlag	1	bslbf
maxRotationSpeedFlag	1	bslbf
maxRotationAccelFlag	1	bslbf
angleUnitFlag	1	bslbf
speedUnitFlag	1	bslbf
accelUnitFlag	1	bslbf
MotionPreferenceBase		MotionPreferenceBaseType
if(maxRotationAngleFlag){		
maxRotationAngle	32	fsbf
}		
if(maxRotationSpeedFlag){		
maxRotationSpeed	32	fsbf
}		
if(maxRotationAccelFlag){		
maxRotationAccel	32	fsbf
}		
if(angleUnitFlag){		
angleUnit	8	bslbf

RigidBodyMotionPrefType {	Number of bits	Mnemonic
}		
if(speedUnitFlag){		
speedUnit	8	bslbf
}		
if(accelUnitFlag){		
accelUnit	8	bslbf
}		
}		
WavePreferenceType {		
maxWaveDistanceFlag	1	bslbf
maxWaveSpeedFlag	1	bslbf
distanceUnitFlag	1	bslbf
speedUnitFlag	1	bslbf
MotionPreferenceBase		MotionPreferenceBaseType
if(maxWaveDistanceFlag){		
maxWaveDistance	32	fsbf
}		
if(maxWaveSpeedFlag){		
maxWaveSpeed	32	fsbf
}		
if(distanceUnitFlag){		
distanceUnit	8	bslbf
}		
if(speedUnitFlag){		
speedUnit	8	bslbf
}		

RigidBodyMotionPrefType {	**Number of bits**	**Mnemonic**
}		
CollidePreferenceType {		
maxCollideSpeedFlag		
speedUnitFlag		
MotionPreferenceBase		MotionPreferenceBaseType
if(maxCollideSpeedFlag){		
maxCollideSpeed	32	fsbf
}		
if(speedUnitFlag){		
speedUnit	8	bslbf
}		
}		
TurnPreferenceType {		
maxTurnSpeedFlag	1	bslbf
speedUnitFlag	1	bslbf
MotionPreferenceBase		MotionPreferenceBaseType
if(maxTurnSpeedFlag){		
maxTurnSpeed	32	fsbf
}		
if(speedUnitFlag){		
speedUnit	8	bslbf
}		
}		
ShakePreferenceType {		
maxShakeDistanceFlag	1	bslbf
maxShakeSpeedFlag	1	bslbf

RigidBodyMotionPrefType {	Number of bits	Mnemonic
distanceUnitFlag	1	bslbf
speedUnitFlag	1	bslbf
MotionPreferenceBase		MotionPreferenceBaseType
if(maxShakeDistanceFlag){		
maxShakeDistance	32	fsbf
}		
if(maxShakeSpeedFlag){		
maxShakeSpeed	32	fsbf
}		
if(distanceUnitFlag){		
distanceUnit	8	bslbf
}		
if(speedUnitFlag){		
speedUnit	8	bslbf
}		
}		
SpinPreferenceType {		
maxSpinSpeedFlag	1	bslbf
speedUnitFlag	1	bslbf
MotionPreferenceBase		MotionPreferenceBaseType
if(maxSpinSpeedFlag){		
maxSpinSpeed	32	fsbf
}		
if(speedUnitFlag){		
speedUnit	8	bslbf
}		