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| Project | **Standard for Actuator Interface for Cyber and Physical World**<https://sagroups.ieee.org/2888/ **>** |
| Title | **Haptic Related Actuator Capabilities** |
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| Re: |  |
| Abstract | This contribution proposes syntax, semantics and example of the haptic related actuator capability. |
| Purpose | To start discussion on purpose of the standard |
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# Introduction

This contribution proposes syntax and semantics of the haptic related actuator capability description vocabulary which comprises the following actuators:

* Heating Capability type
* Cooling capability type
* Vibration capability type

# Data formats for haptic related capabilities

* 1. Heating capability type
	2. Introduction

This Subclause specifies syntax and semantics of heating capabilities of heating actuators.

### **Syntax**

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| --- |
| "heatingActuatorCapabilityData": { "type": "object", "properties": { "actuatorCapabilityBaseData": { "$ref": "#/definitions/actuatorCapabilityBaseData" }, "minIntensity": { "type": "integer" }, "maxIntensity": { "type": "integer" }, "unit": { "$ref": "#/definitions/unitType", "default": "celsius" }, "numOfLevels": { "type": "integer", "minimum": 1 } }, "additionalProperty": false }, |

### **Semantics**

Semantics of the heatingActuatorCapabilityData:

| *Name* | *Definition* |
| --- | --- |
| heatingActuatorCapabilityData | Provide a structure for describing a command for a heating actuator that can increase the room temperature. |
| maxIntensity | Describes the highest temperature that the heating actuator can provide in terms of Celsius (or Fahrenheit). |
| minIntensity | Describes the lowest temperature that the heating actuator 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 unitType. If the unit is not specified, the default unit is Celsius. |
| numOfLevels | Describes the number of temperature levels that the actuator can provide in between the maximum and minimum temperature. |

### **Examples**

This example shows the description of a heating capability with the following semantics. The maximum intensity of the heating actuator is 40 degrees Celsius, and the minimum intensity is 20 degrees Celsius. This specified actuator can support 40 levels in controlling the intensity. This actuator takes 10 milliseconds to start and 20 milliseconds to reach the target intensity. The location of the heating actuator is the left side according to the position model described in locationType

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| {"actuatorCapabilityBaseData": { "zerothOrderDelayTime": 10, "firstOrderDelayTime": 20, "locater": "left" }, "heatingActuatorCapabilityData": { "maxIntensity": 40, "minIntensity": 20, "numOfLevels": 40 }} |

* 1. Cooling capability type
	2. Introduction

This Subclause specifies syntax and semantics of cooling capabilities of cooling actuators.

### **Syntax**

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| --- |
| "coolingActuatorCapabilityData": { "type": "object", "properties": { "actuatorCapabilityBaseData": { "$ref": "#/definitions/actuatorCapabilityBaseData" }, "minIntensity": { "type": "integer" }, "maxIntensity": { "type": "integer" }, "unit": { "$ref": "#/definitions/unitType", "default": "celsius" }, "numOfLevels": { "type": "integer", "minimum": 1 } }, "additionalProperty": false }, |

### **Semantics**

Semantics of the coolingActuatorCapabilityData:

| *Name* | *Definition* |
| --- | --- |
| coolingActuatorCapabilityData | Provide a structure for describing a command for a cooling actuator which can decrease the room temperature. |
| maxIntensity | Describes the lowest temperature that the cooling actuator can provide in terms of Celsius. |
| minIntensity | Describes the highest temperature that the cooling actuator can provide in terms of Celsius. |
| unit | Specifies the unit of the intensity, as a reference to a classification scheme term provided by unitType. If the unit is not specified, the default unit is Celsius. |
| numOfLevels | Describes the number of temperature levels that the actuator can provide in between maximum and minimum temperature. |

### **Examples**

This example shows the description of a cooling capability with the following semantics. The maximum intensity of the cooling actuator is 15 degrees Celsius, and the minimum intensity is 30 degrees Celsius. This specified actuator can support 30 levels in controlling the intensity. This actuator takes 10 milliseconds to start and 30 milliseconds to reach the target intensity. The location of the cooling actuator is the right side according to the position model described in locationType.

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| {"actuatorCapabilityBaseData": { "zerothOrderDelayTime": 10, "firstOrderDelayTime": 30, "locater": "right" }, "coolingActuatorCapabilityData": { "maxIntensity": 15, "minIntensity": 30, "numOfLevels": 30 }} |

* 1. Vibration capability type
	2. Introduction

This Subclause specifies syntax and semantics of vibration capabilities of vibration actuators.

### **Syntax**

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| --- |
| "vibrationActuatorCapabilityData": { "type": "object", "properties": { "actuatorCapabilityBaseData": { "$ref": "#/definitions/actuatorCapabilityBaseData" }, "minIntensity": { "type": "integer" }, "maxIntensity": { "type": "integer" }, "intensityUnit": { "$ref": "#/definitions/unitType", "default": "celsius" }, "numOfIntensityLevels": { "type": "integer", "minimum": 1 }, "minFrequency": { "type": "integer" }, "maxFrequency": { "type": "integer" }, "frequencyUnit": { "$ref": "#/definitions/unitType", "default": "hz" }, "numOfFrequencyLevels": { "type": "integer", "minimum": 1 } }, "additionalProperty": false }, |

### **Semantics**

Semantics of the vibrationActuatorCapabilityData:

| *Name* | *Definition* |
| --- | --- |
| scentActuatorCapabilityData | Provide a structure for describing a command for a vibration actuator. |
| maxIntensity | Describes the maximum intensity that the vibrator actuator can provide in terms of Hertz. |
| unit | Specifies the unit of the intensity, as a reference to a classification scheme term provided by unitType. If the unit is not specified, the default unit is Hertz. |
| numOfLevels | Describes the number of intensity levels that the actuator can provide in between zero and maximum intensity. |

### **Examples**

This example shows the description of a vibration actuator capability with the following semantics. The maximum intensity of the vibration actuator is 600 Hz. This specified actuator can support 4 levels in controlling the intensity. This actuator takes 0 milliseconds to start and 10 milliseconds to reach the target intensity. The location of the heating actuator is the center side according to the position model described in locationType.

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| {"actuatorCapabilityBaseData": { "zerothOrderDelayTime": 0, "firstOrderDelayTime": 10, "locater": "center" }, "vibrationActuatorCapabilityData": { "maxIntensity": 600, "numOfLevels": 4 }} |