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# HID Usage Tables

FOR

## Universal Serial Bus (USB)

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VERSION 1.21

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# 1 Introduction

Usages are part of the HID **Report** descriptor and supply an application developer with information about what a control is actually measuring or reporting. In addition, a **Usage** tag can be used to indicate the vendor's suggested use for a specific control or group of controls. While most of the items within a **Report** descriptor describe the format of the data (e.g. three 8-bit fields) the **Usage** tags define what should be done with the data (e.g x, y, and z input). This feature allows a vendor to ensure that the user sees consistent function assignments to controls across applications. It is also the key feature within HID **Report** descriptors that allows system or application software to know the meaning of data items, or collections of data items, so the data items can be correctly interpreted or routed to the system or application software that consumes them.

## Purpose

This document defines constants that can be interpreted by an application to identify the purpose and meaning of a data field in a HID report.

Usages are also used to define the meaning of groups of related data items. This is accomplished by the hierarchical assignment of Usage information to collections. Usages identify the purpose of a collection and the items it contains. Each **Input**, **Output**, **Feature**, and/or **Collection** data item within a **Collection** item can be assigned a purpose with its own Usage item. Usages assigned to a collection apply to the items within the collection.

In some cases a Usage applied to a collection can redefine the meaning of the Usages it contains. An example of this is the **Usage Selected Indicator** on the LED page.

Usages are also used to specify the meaning of each element within an **Array** data item.

## Terms and Abbreviations

Term	Description
<b>Application</b>	A software program that consumes the data generated by the HID device <b>Input</b> reports, or that controls the HID device through <b>Feature</b> or <b>Output</b> reports. Applications can be games or other programs used by end users or system software components.
<b>Array field</b>	The bit field created by an <b>Input</b> , <b>Output</b> , or <b>Feature</b> main item which is declared as an <b>Array</b> . An array field contains the index of a Usage, not the Usage value.
<b>Control</b>	A control is used to operate or regulate a particular aspect of a device. In this document a control refers broadly to the physical entity on the device that the Usage identifies.
<b>Field</b>	The <b>Input</b> , <b>Output</b> , and <b>Feature</b> main items create a bit field in a report. The <b>Report Size</b> determines the field's width and the associated Usage determines the field's purpose. The offset of a field in a report is determined by the fields that are declared before it.
<b>Pad</b>	If a field is marked as a constant and there is no Usage associated with it, the field will be treated as pad bits and ignored by host software.  <i>Note: Fields created by <b>Main</b> items that do not have Usages attached to them might not be accessible by applications. Whether such access is possible depends on the implementation of the HID device driver.</i>
<b>Usage</b>	Defines the purpose or meaning of an item.

## 2 Management Overview

This document provides lists of Usages and their descriptions that significantly extend the list of Usages provided in the HID Specification. A HID Usage communicates the intended function or meaning of a particular control. Usages provide a description of the data items in a HID device's **Input**, **Output**, and **Feature** reports. The existence of a defined Usage does not guarantee that system or application software will recognize or utilize the data item. Although Usages can be very powerful, there is a potential for misuse. The detail provided in this document will help minimize the misuse or misinterpretation of Usages when they are applied by a device developer.

Usages have been organized into pages of related controls. Each Usage has a Usage ID, Usage name and a detailed description. The Usage names are mnemonics, not definitions. To avoid misleading interpretations based on the Usage name, it is very important that a developer review a Usage's description in detail to ensure that it properly identifies the purpose of the control or device that the Usage is attached to.

In theory, a Usage can be attached to any type of HID control, variable, array, collection, and so forth. In reality, Usages only make sense when they are attached to particular controls and used in certain ways. A relatively small set of Usage types have been defined to help the application software developer better understand what to expect when a particular Usage is found. Each Usage has a Usage type associated with it. The Usage type identifies the item types, flag settings and bit fields organizations that are found with a particular Usage.

Usages can also identify functional devices as a whole, thus providing an easy method for an application to identify devices that provide functions of interest. Such Usages are found attached to application collections that are wrapped around all the items that describe a particular functional device, or a particular function in a complex device. Generally an application will query the HID driver for all application collection Usages that it knows pertain to it. For example, a gaming device driver might look for **Joystick** and **Game Pad** Usages, while a system mouse driver might look for **Mouse**, **Digitizer Tablet** and **Touch Screen** Usages.

As a general rule, the Usages selected by a device developer should be specific enough to dissuade inappropriate use by applications while remaining general enough to allow applications to take advantage of device features if they can. If uncertain, favor the more general Usage to encourage broader application support for your device. An alternative is to use delimiters to define multiple Usages associated with a single control or a device.

Some Usage pages that are in the HID Specification are also found in this document. They are included here because either additional text has been provided to clarify how the Usages are to be used, new Usages have been added to the page, or both. No changes have been made to the Usage values assigned in the HID Specification.

# 3 Usage Pages

The following table lists the currently defined Usage Pages and the section in this document or the specification where each page is described.

Page ID	Page Name	Section or Document
00	<i>Undefined</i>	
01	<a href="#">Generic Desktop Page (0x01)</a>	4
02	<a href="#">Simulation Controls Page (0x02)</a>	5
03	<a href="#">VR Controls Page (0x03)</a>	6
04	<a href="#">Sport Controls Page (0x04)</a>	7
05	<a href="#">Game Controls Page (0x05)</a>	8
06	<a href="#">Generic Device Controls Page (0x06)</a>	9
07	<a href="#">Keyboard/Keypad Page (0x07)</a>	10
08	<a href="#">LED Page (0x08)</a>	11
09	<a href="#">Button Page (0x09)</a>	12
0A	<a href="#">Ordinal Page (0x0A)</a>	13
0B	<a href="#">Telephony Device Page (0x0B)</a>	14
0C	<a href="#">Consumer Page (0x0C)</a>	15
0D	<a href="#">Digitizers Page (0x0D)</a>	16
0E	<a href="#">Haptics Page (0x0E)</a>	17
0F	PID Page	<a href="#">USB Physical Interface Device</a> definitions for force feedback and related devices.
10	<a href="#">Unicode Page (0x10)</a>	18
11-11	<i>Reserved</i>	
12	<a href="#">Eye and Head Trackers Page (0x12)</a>	19
13-13	<i>Reserved</i>	
14	<a href="#">Auxiliary Display Page (0x14)</a>	20
15-1F	<i>Reserved</i>	
20	<a href="#">Sensors Page (0x20)</a>	21
21-3F	<i>Reserved</i>	
40	<a href="#">Medical Instrument Page (0x40)</a>	22
41	<a href="#">Braille Display Page (0x41)</a>	23
42-58	<i>Reserved</i>	
59	<a href="#">Lighting And Illumination Page (0x59)</a>	24
5A-7F	<i>Reserved</i>	
80-83	Monitor Pages	<a href="#">USB Device Class Definition for Monitor Devices</a>
84-87	Power Pages	<a href="#">USB Device Class Definition for Power Devices</a>
88-8B	<i>Reserved</i>	
8C	Bar Code Scanner page	<a href="#">USB Device Class Definition for Point of Sale Devices</a>



8D	Scale page	USB Device Class Definition for <a href="#">Point of Sale Devices</a>
8E	Magnetic Stripe Reading (MSR) Devices	USB Device Class Definition for <a href="#">Point of Sale Devices</a>
8F	Reserved Point of Sale pages	USB Device Class Definition for <a href="#">Point of Sale Devices</a>
90	<a href="#">Camera Control Page (0x90)</a>	25
91	Arcade Page	<a href="#">OAAF Definitions</a> for arcade and coinop related Devices
92	<a href="#">Gaming Device Page (0x92)</a>	26
93-F1CF	<i>Reserved</i>	
F1D0	<a href="#">FIDO Alliance Page (0xF1D0)</a>	27
F1D1-FEFF	<i>Reserved</i>	
FF00-FFFF	Vendor-defined	

Table 3.1: Usage Page Summary

A **bold** Usage definition in the following sections identifies a collection. Non-bold definitions are specific features related to a device that would be applied to individual controls that generate data. In many cases, specific Usages can be used by a number of device types.

## 3.1 HID Usage Table Conventions

Usage ID 0 should always be reserved.

Usage ID 1 through 0x1F are reserved for *top level* collections. These Usage IDs are not necessarily application-level but are used to identify general device types.

**Usage page** values are limited to 16 bits.

Usage ID values are limited to 16 bits.

Usages are 32-bit identifiers, where the high order 16 bits represents the Usage page and the low order 16 bits represents the Usage ID. To allow more compact **Report** descriptors, **Usage Page** items can be declared to specify the high order bits of the **Usage** item and the **Usage** items can declare only the ID portion of the Usage, as follows:

- If the **bSize** field of the **Usage** item equals 1 or 2, the entire 1- or 2-byte data portion of the item is interpreted as a Usage ID.
- If the **bSize** field equals 3, bits 16-31 of the 4-byte data portion of the item are interpreted as a Usage page, and bits 0-15 of the data portion are interpreted as a Usage ID. This interpretation of Usages applies to **Usage**, **Usage Minimum**, and **Usage Maximum** items.

The notation for a 32-bit Usage (sometimes called an extended Usage) in the examples is:

Usage(Usage Page: Usage ID).

## 3.2 Handling Unknown Usages

If a Usage is unknown to an application then the application should ignore it.

If the Usage attached to a collection is unknown to an application, then the application should ignore the collection and all Usages contained in the collection. A collection can be used to modify the meaning of the Usages that it contains, therefore *known* Usages within an unknown collection may not represent their original meaning. An example of this is the **Usage Selected Indicator** on the LED page.

System software provides capabilities for parsing HID **Report** descriptors. In some cases the Usage associated with the top level application collection can be used by the system software as a key to load an application-specific driver or a mapping driver for legacy compatibility.

### 3.3 Usages and Units

For Usages that declare data items as a measurement of time, distance, force, and so forth, an application must look at the units to properly interpret the value defined by a Usage, unless:

1. The Usage specifically declares **Units** as optional.
2. The Usage description defines the units in which the value will be presented.

If **Units** are set to Optional or set to None (have not been declared) then an application can assume the Usage represents a dimensionless value. Any application that ignores **Units** does so at its own risk.

A Usage that declares itself to be a measurement of time would specify whether it was seconds or milliseconds by declaring **Units** and **Unit Exponent** prior to the respective **Main** item declaration. An example of this is the **Flash On Time** Usage on the LED page, which is described as the duration that the indicator is illuminated in flash mode. The duration would be qualified by the values of **Units** and **Unit Exponent**.

When declaring **Units** for a main item, the **Logical Minimum**, **Logical Maximum**, **Physical Minimum**, **Physical Maximum**, and **Unit Exponent** items must also be declared.

*Note: In many cases the coordinate system assumes that the values can vary both positively and negatively from zero (0).*

## 3.4 Usage Types

Usages define a wide variety of device features. However, the way an application treats the data that they generate falls into a relatively small set of categories. This section provides descriptions of frequently used types of Usages, primarily to save redundant text throughout this document. This list is not an exhaustive list of the possible Usage Types. Individual Usage pages can declare their own Usage Types.

Each Usage Type describes how an application should treat the data generated by the **Main** item that the Usage is attached to.

Usage Type names are followed by an abbreviation that is used in the detailed Usage description to identify the default type of a Usage. In some cases Usage Types do not apply and the detailed description will identify how the Usage is to be interpreted.

There are three basic types of information that are described by Usages: controls, collections, and data. In this context, controls are identified with the state of a device (on/off, enable/disable, and so forth), collections group related controls and data together, and data comprises the remaining information that is passed between a device and the host.

*Note: Usage Types are always considered to be the recommended method of handling a Usage. Consult the Usage's definition to determine whether alternative Usage Types may apply.*

### 3.4.1 Usage Types (Controls)

The following table summarizes the control related Usage Types.

Control Type	Logical Min	Logical Max	Flags	Signal	Operation
Linear Control (LC)	-1	1	Relative, Preferred State	Edge	1 increments the control's value. -1 decrements the control's value.
	-Min	Max	Relative, Preferred State	Level	n increments the control's value, -n decrements the control's value.
	Min	Max	Absolute, Preferred State	N/A	The value reported by the control is used directly by the host.
On/Off Control (OOC)	-1	1	Relative, No Preferred	Edge	1 asserts an On condition. -1 asserts an Off condition.
	0	1	Relative, Preferred State	Edge	A 0 to 1 transition toggles the current On/Off state.
	0	1	Absolute, No Preferred	Level	1 asserts an On condition. 0 asserts an Off condition.
Momentary Control (MC)	0	1	Absolute, Preferred State	Level	1 asserts a condition. 0 deasserts the condition.
One Shot Control (OSC)	0	1	Relative, Preferred State	Edge	A 0 to 1 transition triggers an event. A 1 to 0 transition must occur before another event can be triggered.
Re-trigger Control (RTC)	0	1	Absolute, Preferred State	Level	1 triggers an event. When an event completes, if the value is 1 then the event will be triggered again.

Table 3.2: Usage Types (Controls)

#### 3.4.1.1 Linear Control (LC)

In many cases, a control of a linear value is implemented as a pair of increment/decrement buttons, a jog wheel, or a linear control such as a knob or a slide.

When implemented as an increment/decrement control, the two buttons must be translated into a single, 2-bit signed

value and declared as a Relative **Main** item with a **Report Size** equal to 2, where  $-1$  decrements the value,  $+1$  increments it, and no change occurs when 0 is asserted.

A jog wheel is normally implemented as a spring-loaded knob that returns to a fixed center position when released. This control reports a single value of two or more bits which are reported as a signed value and declared as a Relative **Main** item where  $\sim n$  decrements the value,  $+n$  increments it, and no change occurs when 0 is asserted. A jog wheel control is implemented with a resolution of  $+\sim n$ , where the offset of the knob from the center position is proportional to the reported value. The **Report Size** must be declared large enough to contain the signed value  $n$ .

When implemented as a linear knob or slide, the control must be declared as an Absolute **Main** item.

#### 3.4.1.2 On/Off Control (OOC)

An On/Off Control can be implemented in any of the following ways:

- **Two buttons, On and Off.** The two buttons are encoded into a 2-bit signed value and declared as a Relative, No Preferred, **Main** item with **Logical Minimum** and **Logical Maximum** of  $-1$  and  $1$ , respectively. The transition from 0 to  $-1$  generates an Off condition and the transition from 0 to  $+1$  generates an On condition. No change occurs when 0 is asserted.
- **A single button that toggles the On/Off state each time it is pressed.** (single throw momentary switch) The single button is encoded into a 1-bit unsigned value and declared as a Relative, Preferred, **Main** item with a **Logical Minimum** and **Logical Maximum** of 0 and 1, respectively. The transition from 0 to 1 toggles the current On/Off state. No change occurs on the 1 to 0 transition.
- **A toggle switch that maintains the On/Off state mechanically.** (toggle switch) This control is encoded into a 1-bit unsigned value and declared as an Absolute, No Preferred, **Main** item with a **Logical Minimum** and **Logical Maximum** of 0 and 1, respectively. The assertion of 1 generates an On condition and the assertion of 0 generates an Off condition.

#### 3.4.1.3 Momentary Control (MC)

A Momentary Control is a basic push button. A Momentary Control is encoded into a 1-bit value and declared as an Absolute, Preferred, **Main** item with a **Logical Minimum** and **Logical Maximum** of 0 and 1, respectively. A value of 1 generates an asserted condition and 0 generates a non-asserted condition. An example is a mouse button.

#### 3.4.1.4 One Shot Control (OSC)

A One Shot Control is a push button that triggers a single event or action. A One Shot Control is encoded into a 1-bit value and declared as a Relative, Preferred, **Main** item with a **Logical Minimum** and **Logical Maximum** of 0 and 1, respectively. A 0 to 1 transition initiates an event. Nothing occurs on a 1 to 0 transition but it is required before another event can occur. An example is degauss.

#### 3.4.1.5 Re-Trigger Control (RTC)

A Re-Trigger Control is a push button that triggers a repeating event as long as it is asserted. A Re-Trigger Control is encoded into a 1-bit value and declared as an Absolute, Preferred, **Main** item with a **Logical Minimum** and **Logical Maximum** of 0 and 1, respectively. A 0 to 1 transition initiates the first event. When each event terminates, if the control is still asserted (1) then another event will occur. An example is an autorepeat fire button.

### 3.4.2 Usage Types (Data)

The following table summarizes the data-related Usage Types.

Abbreviation	Type	Flags	Description
Sel	Selector	Array	Contained in a Named Array (NAry).
SV	Static Value	Constant, Variable, Absolute	A read-only multiple-bit value.
SF	Static Flag	Constant, Variable, Absolute	A read-only single-bit value.
DV	Dynamic Value	Data, Variable, Absolute	A read/write multiple-bit value.
DF	Dynamic Flag	Data, Variable, Absolute	A read/write single-bit value.

Table 3.3: Usage Types (Data)

#### 3.4.2.1 Selector (Sel)

Selectors come in three forms:

- **One selection of a set.** Radio buttons are a mechanically linked set of buttons where one selection is always valid. This is a perfect example of the *one selection of a set* form. A radio button set is defined by a **Main** item with the Array flag set and the **Report Count** set to 1. The index returned in the array field corresponds to the pressed button (or selection). A Usage must be declared for each selection. The array field never returns an index of NULL because one Usage is always valid. An example is [Display Status](#) on [Auxiliary Display Page \(0x14\)](#).
- **N selections of a set.** More than one selection (button) can be valid at a time. Multiple selections can be returned to the system at one time in a multi-byte array. The *n selections of a set* form is defined by a **Main** item with the Array flag set and the **Report Count** set to  $n$ , where  $n$  is the number of selections that can be reported in a single report. An example is a keyboard.
- **Any selection of a set.** The control is implemented as a set of bit fields in which each bit represents a single selection. This control is defined by a **Main** item with the Variable flag set and the **Report Size** equal to 1. The **Report Count** will be equal to the number of selections in the set.

Selectors therefore can be implemented in a number of ways: Array[1] (one selection of a set), Array[ $n$ ] ( $n$  selections of a set), or bitmap (any selection of a set).

Optionally, the array field or set can be named by wrapping a set of Selectors in a logical collection with a Usage attached to it. For details, see [Section 3.4.3.1 Named Array \(NAry\)](#)

#### 3.4.2.2 Static Value (SV)

Static values are used to declare a fixed features in a device. They are defined as Constant and treated as read-only information. Therefore, asserting this field in a **Set\_Report** command has no defined effect.

#### 3.4.2.3 Static Flag (SF)

Static flags are used to declare the existence of a fixed feature in a device. If a Static Flag Usage is found in a **Report** descriptor then the field must be read to determine whether the feature identified by the flag exists. A value of 1 indicates existence and a value of 0 indicates non-existence. The absence of a Static Flag Usage implies that the flag is false or the feature defined by the flag is not supported by the device. A Static Flag must be declared as a Constant. To be accessible by applications, a Static Flag must have a Usage assigned to it.

Static Flags are typically declared in a **Feature** report as a single-bit field where the value is always read as 1. Attempting to modify this field in a **Set\_Report** command has no effect on a Static Flag.

#### 3.4.2.4 Dynamic Flag (DF)

Dynamic Flags are used to declare the existence of a host-controllable feature in a device. The absence of a Dynamic Flag Usage implies that the flag is false or the feature defined by the flag is not supported by the device.

Dynamic Flags are typically declared in a report as a single-bit field, where a value of 1 returned by the device indicates that the feature is enabled. The assertion of 1 by the host will cause the feature to be evoked and the assertion of 0

indicates that the feature is to be disabled or ignored if the feature is a one-time event (such as Degauss or Clear Display). A Dynamic Flag **Main** item must be declared as Data.

#### 3.4.2.5 Dynamic Value (DV)

A Dynamic Value is an  $n$ -bit field that contains a value associated with a control. The associated **Main** item will have the Data and Variable flags set. A Dynamic Value **Main** item must be declared as Data.

*Note: More advanced devices may allow a Usage declared as a Static type to be Dynamic. Always check the Constant/Data flag in an **Input**, **Output** or **Feature Main** item.*



### 3.4.3 Usage Types (Collection)

The following table summarizes the collection-related Usage Types.

Abbreviation	Type	Collection Type	Description
NArY	Named Array	Logical	A collection that encompasses an array definition, naming the array set or the field created by the array.
CA	Application Collection	Application	Applies a name to a top level collection which the operating system uses to identify a device and possibly remap to a legacy API.
CL	Logical Collection	Logical	A logical collection of items.
CP	Physical Collection	Physical	A physical collection of items.
US	Usage Switch	Logical	Modifies the purpose or function of the Usages (controls) that it contains.
UM	Usage Modifier	Logical	Modifies the purpose or function of the Usages (controls) that contains it.

Table 3.4: Usage Types (Collection)

#### 3.4.3.1 Named Array (NArY)

To simplify for an application the process of finding a set of selectors, whether defined as an Array Field or a bitmap, the set of selectors can be named by wrapping them in a logical collection and applying a Usage to the collection. Usages applied in this way are called Named Array Usages.

#### 3.4.3.2 Collection Application (CA)

The Collection Application Usage type identifies Usages that are used only in application-level collections. An application collection identifies a HID device or a functional subset of a complex device. An operating system uses the Usage associated with this collection to link the device to its controlling application or driver. Common examples are a keyboard or mouse. A keyboard with an integrated pointing device could contain two different application collections.

*Note: **Data** reports cannot span application collections.*

#### 3.4.3.3 Collection Logical (CL)

The Collection Logical Usage type identifies a Usage applied to a logical collection. Logical collections can be used to further define the purpose of the items or controls that they contain.

#### 3.4.3.4 Collection Physical (CP)

The Collection Physical Usage type identifies a Usage applied to a physical collection, usually a collection of axes. A physical collection is used for a set of data items that represent data points collected at one geometric point. This is useful for sensing devices that may need to associate sets of measured or sensed data with a single point. It does not indicate that a set of data values comes from one device, such as a keyboard. In the case of a device that reports the position of multiple sensors, physical collections are used to show which data comes from which sensor.

#### 3.4.3.5 Usage Switch (US)

The Usage Switch Usage type identifies a Usage applied to a logical collection that modifies the purpose of the Usages in that collection. An example is indicators. To avoid having to define a Usage for every control that could possibly use an indicator (for example, Play/Play Indicator, etc.) a Usage Switch collection can be wrapped around a Usage (Play) to create an indicator for the same function. Usage Switches often modify the type of the contained Usage as well.

#### 3.4.3.6 Usage Modifier (UM)

The Usage Modifier Usage type identifies a Usage applied to a logical collection. This logical collection is always contained in another logical collection. The purpose and possibly the type of the Usage attached to the encompassing collection is modified. For instance the Usage attached to the encompassing collection may not normally be defined as a collection.

### 3.4.4 Alternate Types

Usage Types are a guide, not the rule. The flags, **Logical Minimum** and **Logical Maximum** values, and other **Main** item attributes must be evaluated by applications and system software to determine the true purpose, meaning, or interpretation of a control.

In many cases, a Usage can take on the attributes of a Usage type other than its default type. The alternate type can be declared by a collection in which the Usage is found or implied by the way it is declared in a **Report** descriptor. For example, **Usage In Use Indicator** from the LED page is an example of an alternate Usage type being applied to a Usage. When a Usage is wrapped in a **Usage In Use Indicator** collection, it becomes an On/Off Control (OOC).

In other cases, a Usage can be declared as either a Static Value (SV) or a Dynamic Value (DV). For example, in a screen saver, the Screen Saver Delay might be fixed on one device and variable on another. The same thing can happen with Usages declared as Static Flag (SF) or Dynamic Flag (DF).

Another example is a Usage that is declared as either an On/Off Control (OOC) or a Selector (Sel). A device that can support a variety of operational modes will declare individual bits as On/Off Controls to identify which modes are enabled. However, when the device is running, only one mode will be in effect at a time. The device would then declare the same Usage as a Selector and report this in a Named Array field to identify the mode associated with the current data. For example, a tape transport could have three states: Stopped, Paused, and Playing. This could be implemented as three individual bits where only one bit is true at a time, or as a 2-bit field in which 0 = Stopped, 1 = Paused, and 3 = Playing.

## 3.5 System Controls

Applications look at the Usage applied to top-level application collections to identify devices. System software that supports keyboards, mice, and joysticks follow the same conventions. If a device vendor wants a device to be recognized by the system software as one of these devices, then the device must follow the conventions described in this section.

### 3.5.1 Keyboard

Typical system software will search for application collections tagged with either a Keyboard or a Keypad Usage. When found, the Usages contained in these collections will be treated as standard system keyboard input. All devices that use these declarations will have their output routed to the same destination. That is, typing on any device will affect the active application.

### 3.5.2 Mice

Typical system software will search for application collections tagged with either a Mouse or a Pointer Usage. When found, the Usages generated by these collections will be treated as standard system pointer input. All devices that use these declarations will have their output routed to the same destination. That is, moving any mouse will affect the system pointer.

### 3.5.3 Joysticks

Typical system software will search for application collections tagged with either a Joystick or a Game Pad Usage. When found, the Usages generated by these collections will be treated as standard system joystick (gaming device) input. Devices that use these declarations will have their output routed to separate destinations, allowing multiple-player applications.

## 3.6 HID LANGIDs

This section identifies a set of conventions that allow static data to be associated with individual controls. These conventions are an extension of the string descriptors that can currently be attached to controls.

The first two bytes of a USB string descriptor define the length and type of the descriptor, respectively. The byte wide length field allows a *string* to be up to 253 bytes long. The second byte of a string is always the *string* descriptor type (0x03). These bytes are followed by 16-bit UNICODE characters.

Part	Offset/Size (Bytes)	Description	Sample Value
bLength	0/1	Size of this descriptor in bytes.	0x06
bDescriptorType	1/1	String (assigned by USB).	0x03
bString	2/bLength-2	UNICODE encoded string	0x0041, 0x0042 = (AB)

Table 3.5: String Descriptor

Strings on a HID device are accessed using a Language ID (LANGID) and a string index. The LANGID is a 16-bit value where the low order 10 bits are *Primary Language ID* and the high order 6 bits are the *Sublanguage ID*. The Primary Language ID 0xFF has been permanently assigned to the HID class for it's use. The Sublanguage IDs are defined in [Table 3.8 HID Sublanguage IDs](#). The String Index, String Minimum and String Maximum local items allow string indices to be associated with individual main items.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Primary Language ID</b>										<b>Sublanguage ID</b>					
0xFF (HID)										Assigned by HID					

Table 3.6: LANGID Format

Individual Usages define which HID LANGIDs they support and any support information the LANGID may require.

Remarks:

- If a device declares LANGID's other than HID LANGID then return an empty string if there is no valid Unicode representation for it.
- All values are transmitted with little-endian byte alignment and in packed structures unless otherwise stated in the Usage description.

HID LANGIDs define how their associated string data is to be interpreted.

String descriptors are global to a device and assumed to be static, therefore cacheable. If a device requires that the Private Data varies as a function Configuration or Interface settings then a device must use nonoverlapping indices to ensure that string caches do not need to be invalidated,

To implement HID LANGIDs the following steps are required:

1. String index 0 always defines a list of the LANGIDs supported by the HID device. A HID LANGID must be included in the list.
2. Any main item that utilizes HID LANGIDs must have a string index attached to it, using String Index, String Minimum or String Maximum local items.
3. A *string* must be returned by the device, which contains the data identified by the LANGID.

To access a HID LANGID string associated with a control, the host will send a `GetDescriptor(String_DESCRIPTOR, HID_LANGID, String Index)` request to the device, where `String_DESCRIPTOR = 0x03`, the `HID_LANGID` is defined in Table 3.6 LANGID Format , and the String Index is defined the String local item associated with the control.

Part	Offset (Bytes)	Size (Bytes)	Description	Sample Value
<code>bmRequestType</code>	0	1	Device to Host, Standard, Device	10000000B
<code>bRequest</code>	1	1	GET_DESCRIPTOR	0x06
<code>wValue (High)</code>	2	1	STRING_DESCRIPTOR	0x03
<code>wValue (Low)</code>	3	1	String Index	0x03
<code>wIndex</code>	4	2	HID(Usage Defined)	
<code>wLength</code>	6	2	Length of string	

Table 3.7: GetDescriptor(String) Request

Sublanguage ID	LANGID Name	Description
00	<i>Reserved</i>	<i>Reserved</i>
01	Usage Data Descriptor	Allows a Usage to define a data structure that is specific to the Usage
02 - 3B	<i>Reserved</i>	<i>Reserved</i>
3C	Vendor Defined HID LANGID 1	
3D	Vendor Defined HID LANGID 2	
3E	Vendor Defined HID LANGID 3	
3F	Vendor Defined HID LANGID 4	

Table 3.8: HID Sublanguage IDs

### 3.6.1 Usage Data Descriptor (0x01)

This HID LANGID allows a Usage to define a private descriptor. A Usage that requires private data must define the format of the block of data associated with the Usage. The first two bytes of the table are identical to those defined in a standard USB string descriptor: `bLength` and `bDescriptorType`. The size and number of remaining fields depends on the Usage.

Part	Offset (Bytes)	Size (Bytes)	Value	Description
<code>bLength</code>	0	1	Number	Size of this descriptor in bytes
<code>bDescriptorType</code>	1	1	Constant	String (assigned by USB)
Field 1	2	Field 1 size	Usage Dependent	Usage defined fields
Field 2	Field 1 offset + Field 1 size	Field 2 size	Usage Dependent	
Field 3	Field 2 offset + Field 2 size	Field 3 size	Usage Dependent	
...	...	...	Usage Dependent	
Field $n$	Field $n - 1$ offset + Field $n - 1$ size	Field $n$ size	Usage Dependent	

Table 3.9: Usage Data Descriptor

### 3.6.2 Vendor Defined HID LANGID (0x3C - 0x3F)

Four HID LANGIDs are reserved for vendor specific use. The first two bytes of the table are identical to those defined in a standard USB string descriptor, and up to 253 bytes of data can be defined by the vendor. Note that Vendor Defined HID LANGIDs allow a vendor to associate additional data with a standard Usage. For Vendor Defined Usages, the Usage Descriptor LANGID may also be used, since the definition of the Usage Descriptor depends on the Vendor Defined Usage.

The data types supported by Usage Descriptors can expand on those already supported by standard USB descriptors. These can include 64-bit signed and unsigned integers, 32, 64 and 128-bit IEEE format floating point, etc. The Usage Descriptor defined by the Usage will provide detailed information about the data types that are used.

Part	Offset (Bytes)	Size (Bytes)	Value	Description
bLength	0	1	Number	Size of this descriptor in bytes
bDescriptorType	1	1	Constant	String (assigned by USB)
Vendor Defined Data	2	$n$ ( $n \leq 253$ )	Vendor Defined	Vendor defined fields

Table 3.10: Vendor Defined Descriptor

## 4 Generic Desktop Page (0x01)

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Pointer</b>	CP	4.1
02	<b>Mouse</b>	CA	4.1
03-03	<i>Reserved</i>		
04	<b>Joystick</b>	CA	4.1
05	<b>Gamepad</b>	CA	4.1
06	<b>Keyboard</b>	CA	4.1
07	<b>Keypad</b>	CA	4.1
08	<b>Multi-axis Controller</b>	CA	4.1
09	<b>Tablet PC System Controls</b>	CA	4.1
0A	<b>Water Cooling Device [6]</b>	CA	4.1
0B	<b>Computer Chassis Device [6]</b>	CA	4.1
0C	<b>Wireless Radio Controls [13]</b>	CA	4.1
0D	<b>Portable Device Control [23]</b>	CA	4.1
0E	<b>System Multi-Axis Controller [33]</b>	CA	4.1
0F	<b>Spatial Controller [39]</b>	CA	4.1
10	<b>Assistive Control [49]</b>	CA	4.1
11	<b>Device Dock [57]</b>	CA	4.15
12	<b>Dockable Device [57]</b>	CA	4.15
13-2F	<i>Reserved</i>		
30	X	DV	4.2
31	Y	DV	4.2
32	Z	DV	4.2
33	Rx	DV	4.2
34	Ry	DV	4.2
35	Rz	DV	4.2
36	Slider	DV	4.3
37	Dial	DV	4.3
38	Wheel	DV	4.3
39	Hat Switch	DV	4.3
3A	<b>Counted Buffer</b>	CL	4.6
3B	Byte Count	DV	4.6
3C	Motion Wakeup	OSC/DF	4.3
3D	Start	OOC	4.3
3E	Select	OOC	4.3
3F-3F	<i>Reserved</i>		
40	Vx	DV	4.4
41	Vy	DV	4.4
42	Vz	DV	4.4
43	Vbrx	DV	4.4

44	Vbry	DV	4.4
45	Vbrz	DV	4.4
46	Vno	DV	4.4
47	Feature Notification	DV/DF	4.8
48	Resolution Multiplier	DV	4.3
49	Qx [39]	DV	4.14
4A	Qy [39]	DV	4.14
4B	Qz [39]	DV	4.14
4C	Qw [39]	DV	4.14
4D-7F	<i>Reserved</i>		
80	<b>System Control</b>	CA	4.5
81	System Power Down	OSC	4.5
82	System Sleep	OSC	4.5
83	System Wake Up	OSC	4.5
84	System Context Menu	OSC	4.5
85	System Main Menu	OSC	4.5
86	System App Menu	OSC	4.5
87	System Menu Help	OSC	4.5
88	System Menu Exit	OSC	4.5
89	System Menu Select	OSC	4.5
8A	System Menu Right	RTC	4.5
8B	System Menu Left	RTC	4.5
8C	System Menu Up	RTC	4.5
8D	System Menu Down	RTC	4.5
8E	System Cold Restart	OSC	4.5
8F	System Warm Restart	OSC	4.5
90	D-pad Up	OOC	4.7
91	D-pad Down	OOC	4.7
92	D-pad Right	OOC	4.7
93	D-pad Left	OOC	4.7
94	Index Trigger [39]	MC/DV	4.14
95	Palm Trigger [39]	MC/DV	4.14
96	<b>Thumbstick</b> [39]	CP	4.14
97	System Function Shift [42]	MC	4.5
98	System Function Shift Lock [42]	OOC	4.5
99	System Function Shift Lock Indicator [42]	DV	4.5
9A	System Dismiss Notification [53]	OSC	4.5
9B	System Do Not Disturb [61]	OOC	4.5
9C-9F	<i>Reserved</i>		
A0	System Dock	OSC	4.5
A1	System Undock	OSC	4.5



A2	System Setup	OSC	4.5
A3	System Break	OSC	4.9
A4	System Debugger Break	OSC	4.9
A5	Application Break	OSC	4.9
A6	Application Debugger Break	OSC	4.9
A7	System Speaker Mute	OSC	4.5
A8	System Hibernate	OSC	4.5
A9-AF	<i>Reserved</i>		
B0	System Display Invert	OSC	4.10
B1	System Display Internal	OSC	4.10
B2	System Display External	OSC	4.10
B3	System Display Both	OSC	4.10
B4	System Display Dual	OSC	4.10
B5	System Display Toggle Int/Ext Mode	OSC	4.10
B6	System Display Swap Primary/Secondary	OSC	4.10
B7	System Display Toggle LCD Autoscale	OSC	4.10
B8-BF	<i>Reserved</i>		
C0	<b>Sensor Zone</b> [6]	CL	4.11
C1	RPM [6]	DV	4.11
C2	Coolant Level [6]	DV	4.11
C3	Coolant Critical Level [6]	SV	4.11
C4	Coolant Pump [6]	US	4.11
C5	<b>Chassis Enclosure</b> [6]	CL	4.11
C6	Wireless Radio Button [13]	OOC	4.12
C7	Wireless Radio LED [13]	OOC	4.12
C8	Wireless Radio Slider Switch [13]	OOC	4.12
C9	System Display Rotation Lock Button [24]	OOC	4.10
CA	System Display Rotation Lock Slider Switch [24]	OOC	4.10
CB	Control Enable [22]	DF	4.13
CC-CF	<i>Reserved</i>		
D0	Dockable Device Unique ID [57]	DV	4.15
D1	Dockable Device Vendor ID [57]	DV	4.15
D2	Dockable Device Primary Usage Page [57]	DV	4.15
D3	Dockable Device Primary Usage ID [57]	DV	4.15
D4	Dockable Device Docking State [57]	DF	4.15
D5	Dockable Device Display Occlusion [57]	CL	4.15
D6	Dockable Device Object Type [58]	DV	4.15
D7-FFFF	<i>Reserved</i>		

Table 4.1: Generic Desktop Page

## 4.1 Application Usages

Usage Name	Usage Type	Description
<b>Pointer</b>	CP	A collection of axes that generates a value to direct, indicate, or point user intentions to an application.
<b>Mouse</b>	CA	A hand-held, button-activated input device that when rolled along a flat surface, directs an indicator to move correspondingly about a computer screen, allowing the operator to move the indicator freely in select operations or to manipulate text or graphics. A mouse typically consists of two axes (X and Y) and one, two, or three buttons.
<b>Joystick</b>	CA	<p>A manual control or cursor device. A joystick minimally consists of two variable axes (X and Y) and two buttons. A joystick is typically a rotational motion sensor. However, for legacy reasons, it is defined using linear axes.</p> <p>Traditionally, a joystick driver applies its own scaling to values returned from a joystick. That is, the driver simply linearizes and translates the range of values generated by the stick into normalized values between 0 and 64K, where 32K is centered. The application (game) then interprets the normalized values as necessary. Because of this, joysticks normally do not declare <b>Units</b> or <b>Physical Minimum</b> and <b>Physical Maximum</b> values for their axes. Depending on the driver, these items may be ignored if they are declared.</p>
<b>Gamepad</b>	CA	A manual control or cursor device. A game pad minimally consists of a thumb-activated rocker switch that controls two axes (X and Y) and has four buttons. The rocker switch consists of four contact closures for up, down, right, and left.
<b>Keyboard</b>	CA	The primary computer input device. A <b>Keyboard</b> minimally consists of 103 buttons as defined by the <b>Boot Keyboard</b> definition.
<b>Keypad</b>	CA	Any keyboard configuration that does not meet the minimum requirements of the <b>Boot Keyboard</b> . <b>Keypad</b> often refers to a supplementary calculator-style keyboard.
<b>Multi-axis Controller</b>	CA	An input device used to orient eyepoints and or objects in 3 dimensional space. A Multi-axis Controller typically consists of six, variable axes (X, Y, Z, Rx, Ry and Rz) and is used by CAD/digital content creation applications for model manipulation and visualization in 3D space. The device may incorporate zero or more buttons.
<b>Tablet PC System Controls</b>	CA	System controls on Tablet PCs. This collection is not intended to contain display or audio data nor touchscreen input. Appropriate controls might be buttons, wheels, or simple indicators. This collection is intended to be opened by the operating system in exclusive mode and is not meant for application developers to open directly.
<b>Water Cooling Device</b>	CA	A collection of sensors and controls that represents a device using liquid to provide cooling of a thermal environment. A water cooling device contains at least one thermal reporting control.
<b>Computer Chassis Device</b>	CA	A collection of usages that represent data about the condition, state, and controls of sensors and devices attached to a chassis containing the motherboard and associated components (e.g., processor, graphics controller, hard drives) of a computing device.
<b>Wireless Radio Controls</b>	CA	A collection of buttons or switches that enable all-wireless radio communication to be turned on/off.
<b>Portable Device Control</b>	CA	A collection of controls on the portable devices, for example, volume controls, rotation lock, power, camera controls, home button, etc.

<b>System Multi-Axis Controller</b>	CA	A collection of controls that may contain the same controls as listed in Multi-Axis Controller (Usage 0x08) and/or additional associated controls such as wheels, dials, buttons etc... for exclusive use of the System.
<b>Spatial Controller</b>	CA	A handheld input device that users move freely through space to provide position and orientation input.
<b>Assistive Control</b>	CA	A manual control or cursor device. An assistive control device may consist of buttons or a pointing input control to communicate.

## 4.2 Axis Usages

For X, Y, Z, Rx, Ry, and Rz, the declaration of **Units** is optional. If **Units** is None or not declared, these values should be considered as dimensionless.

Usage Name	Usage Type	Description
X	DV	A linear translation in the X direction. Report values should increase as the control's position is moved from left to right.
Y	DV	A linear translation in the Y direction. Report values should increase as the control's position is moved from far to near.
Z	DV	A linear translation in the Z direction. Report values should increase as the control's position is moved from high to low ( <i>Z</i> ).
Rx	DV	A rotation about the X axis. Angular position report values follow the righthand rule.
Ry	DV	A rotation about the Y axis. Angular position report values follow the righthand rule.
Rz	DV	A rotation about the Z axis. Angular position report values follow the righthand rule.

### 4.3 Miscellaneous Controls

Usage Name	Usage Type	Description
Slider	DV	A linear control for generating a variable value, normally in the form of a thumb slide in a slot. Report values should increase as controls are moved from near to far.
Dial	DV	A rotary control for generating a variable value, normally in the form of a knob spun by the index finger and thumb. Report values should increase as controls are spun clockwise. This usage does not follow the HID orientation conventions.
Wheel	DV	A rotary control for generating a variable value, normally rolled, unlike a dial. Report values should increase as controls are rolled forward, away from the user. This usage does not follow the HID orientation conventions.
Hat Switch	DV	A specialized mechanical configuration of switches generating a variable value with a NULL state. The switches are arranged around a springloaded knob. When the knob is tilted in the direction of a switch, its contacts are closed. A typical example is four switches that are capable of generating information about four possible directions in which the knob can be tilted. Intermediate positions can also be decoded if the hardware allows two switches to be reported simultaneously.
Motion Wakeup	DF	<p>Enables the generation of a USB remote wakeup when the device detects motion. Motion Wakeup is always enabled after a USB Reset event is detected by the device. Then host can also assume that the state of the Motion Wakeup flag is maintained while the device is suspended.</p> <p>For example, a mouse may generate a remote wakeup when a button is pressed or when it is moved. For some implementations, a laptop user may want to disable the wakeup on motion because it draws more power.</p>
Start	OOC	Session start button. Initiates a session within an application.
Select	OOC	Application option select button. Selects application configuration options.
Resolution Multiplier	DV	Defines a Resolution Multiplier for a Control.

### 4.3.1 Resolution Multiplier

A HID describes the resolution of a control by using the methods described in the HID Specification, v1.11, section 6.2.2.7 *Global Items – Remarks*. However, the resolution of a control in this model is static. If a device has the capability to vary the resolution of one or more of its controls, the resolution of those controls can be set by defining an associated *Resolution Multiplier* control.

The Resolution Multiplier control must be contained in the same Logical Collection as the control(s) to which it is to be applied. If no Resolution Multiplier is defined, then the Resolution Multiplier defaults to 1. If more than one control exists in a Logical Collection, the Resolution Multiplier is associated with all controls in the collection. If no Logical Collection is defined, the Resolution Multiplier is associated with all controls in the report.

The Resolution Multiplier is applied after all the normal resolution calculations have been performed for an affected control. The Resolution Multiplier is calculated as below:

$$EffectiveResolutionMultiplier = \left( \left( \frac{RMV - LMin}{LMax - LMin} \times (PMax - PMin) \right) + PMin \right) \times 10^{UnitExponent}$$

Variable	Description
<i>RMV</i>	Resolution Multiplier Value
<i>LMin</i>	Logical Minimum
<i>LMax</i>	Logical Maximum
<i>PMin</i>	Physical Minimum
<i>PMax</i>	Physical Maximum

For example, if a Wheel Control is defined as below:

```
Usage Page (Generic Desktop) (0x01)
Usage (Wheel) (0x38)
Logical Minimum (-127)
Logical Maximum (127)
Report Count (1)
Report Size (8)
Input (Data, Var, Rel)
```

Then, the Wheel control delivers one count per *detent* via a 1-byte field of an Input Report. However if a Resolution Multiplier feature is included in the report with the Wheel as below:

```
Collection (Logical)
  Usage Page (Generic Desktop) (0x01)
  Usage (Resolution Multiplier) (0x48)
  Logical Minimum (0)
  Logical Maximum (15)
  Physical Minimum (1)
  Physical Maximum (16)
  Report Size (4)
  Report Count (1)
  Feature (Data, Var, Abs)
  Usage Page (Generic Desktop) (0x01)
  Usage (Wheel) (0x38)
  Logical Minimum (-127)
  Logical Maximum (127)
  Report Count (1)
  Report Size (8)
  Input (Data, Var, Rel)
End Collection
```

Then, the Effective Resolution Multiplier for the Wheel may vary from 1 to 16 depending on the setting of the Resolution Multiplier feature. If the Resolution Multiplier feature is set to 7, then the Effective Resolution Multiplier is 8, meaning that the resolution of the Wheel control is 8 counts per detent.

Negative Effective Resolution Multipliers may be used to reverse the sense of a control.

Because OS implementations will generally divide the control's reported count by the Effective Resolution Multiplier, designers should take care not to establish a potential Effective Resolution Multiplier of zero. This may be done by ensuring that Physical Min and Physical Max are nonzero and have the same sign.

The Resolution Multiplier is a scalar (unitless) multiplier. It may not be used to convert units from one system to another.

## 4.4 Vector Usages

For the usages  $V_x$ ,  $V_y$ ,  $V_z$ ,  $V_{brx}$ ,  $V_{bry}$ ,  $V_{brz}$ , and  $V_{no}$ , **Units** are always required to determine the meaning of the vector. Rotational vectors are also identified by **Units**. These usages are used when declaring velocity, acceleration, force, electric field, and similar kinds of vectors in the respective direction and frame of reference.

Usage Name	Usage Type	Description
$V_x$	DV	A vector in the X direction. Report values should increase as the vector increases in the positive X direction (from left to right). Negative values represent vectors in the negative X direction.
$V_y$	DV	A vector in the Y direction. Report values should increase as the vector increases in the positive Y direction (from far to near). Negative values represent vectors in the negative Y direction.
$V_z$	DV	A vector in the Z direction. Report values should increase as the vector increases in the positive Z direction (from high to low). Negative values represent vectors in the negative Z direction.
$V_{brx}$	DV	A vector in the X direction relative to the body of an object. Report values should increase as the vector increases in the positive X direction (forward). Negative values represent vectors in the negative X direction. X is the <i>forward</i> axis for an object.
$V_{bry}$	DV	A vector in the Y direction relative to the body of an object. Report values should increase as the vector increases in the positive Y direction (to the right from an observer facing forward on the object). Negative values represent vectors in the negative Y direction.
$V_{brz}$	DV	A vector in the Z direction relative to the body of an object. Report values should increase as the vector increases in the positive Z direction (down from an observer facing forward on the object). Negative values represent vectors in the negative Z direction.
$V_{no}$	DV	A non oriented vector or value. The units define a physical measurement not related to a specific axis or orientation. An example would be pressure or temperature.



## 4.5 System Controls

System controls are a special category of usages that affect the system as a whole. They are pulled together in a **System Control** collection to make them easy for system software to identify.

Usage Name	Usage Type	Description
<b>System Control</b>	CA	A application-level collection that contains system-software-specific usages. System software will search specifically for this collection for those controls that affect the system globally.
System Context Menu	OSC	Evokes a context-sensitive menu.
System Main Menu	OSC	Evokes the OS main-level selection menu.
System App Menu	OSC	Displays an application-specific menu.
System Menu Help	OSC	Displays the help menu.
System Menu Exit	OSC	Exits a menu.
System Menu Select	OSC	Selects a menu item.
System Menu Right	RTC	Menu select right.
System Menu Left	RTC	Menu select left.
System Menu Up	RTC	Menu select up.
System Menu Down	RTC	Menu select down.
System Function Shift	MC	Indicates the state of the feature. 1=on, 0=off. Usually this maps directly to the state of the <i>Fn</i> key, but may be reversed if the System Function Shift Lock is also on.
System Function Shift Lock	OOC	Locks the System Function Shift state. This is an On/Off control with a recommended implementation of Relative, Preferred State for physically non-locking keys, and Absolute, No Preferred state for physically locking keys.
System Function Shift Lock Indicator	DV	The value of a visual indicator of System Function Shift Lock.
System Dismiss Notification	OSC	Dismisses active notification (e.g. pop-ups/alerts) from system environments and applications that arrest the user's attention (e.g. Voice Assistants, VOIP calls, Alarms). Many modern devices have a paradigm of dismissing such notifications using the <i>Power</i> button.
System Do Not Disturb	OOC	Toggle system-wide <i>Do Not Disturb</i> (DND) mode On/Off.

### 4.5.1 Power Controls

Power controls can step the system through the following states: Full Power, Low Power, and Power Down. Power control usages found in a **System Control** collection affect system level power. Those declared outside of a **System Collection** affect device level power.

Usage Name	Usage Type	Description
System Power Down	OSC	Asserted when the intended action is to initiate system-wide power down now from Full Power or Sleep states.
System Sleep	OSC	Asserted when the intended action is to initiate system-wide low power mode now. If the system is already in the Low Power state, there is no effect.
System Wake Up	OSC	Asserted when the intended action is to initiate system-wide Full Power state now. If the system is already in the Full Power, there is no effect.

System Cold Restart	OSC	Asserted when the intended action is to restart the system at the most primitive level, similar to at Power Up.
System Warm Restart	OSC	Asserted when the intended action is to restart the operating system but not necessarily the lowest level functions such as BIOS enumeration and RAM checks.
System Dock	OSC	Asserted when the intended action is to prepare a portable system for docking with a docking station.
System Undock	OSC	Asserted when the intended action is to prepare a portable system for removal from a docking station.
System Setup	OSC	Asserted when the intended action is to enter the BIOS-level system setup program.
System Speaker Mute	OSC	Asserted when the intended action is to mute the system speaker.
System Hibernate	OSC	Asserted when the intended action is to place the system in a "deeper" sleep state than System Sleep

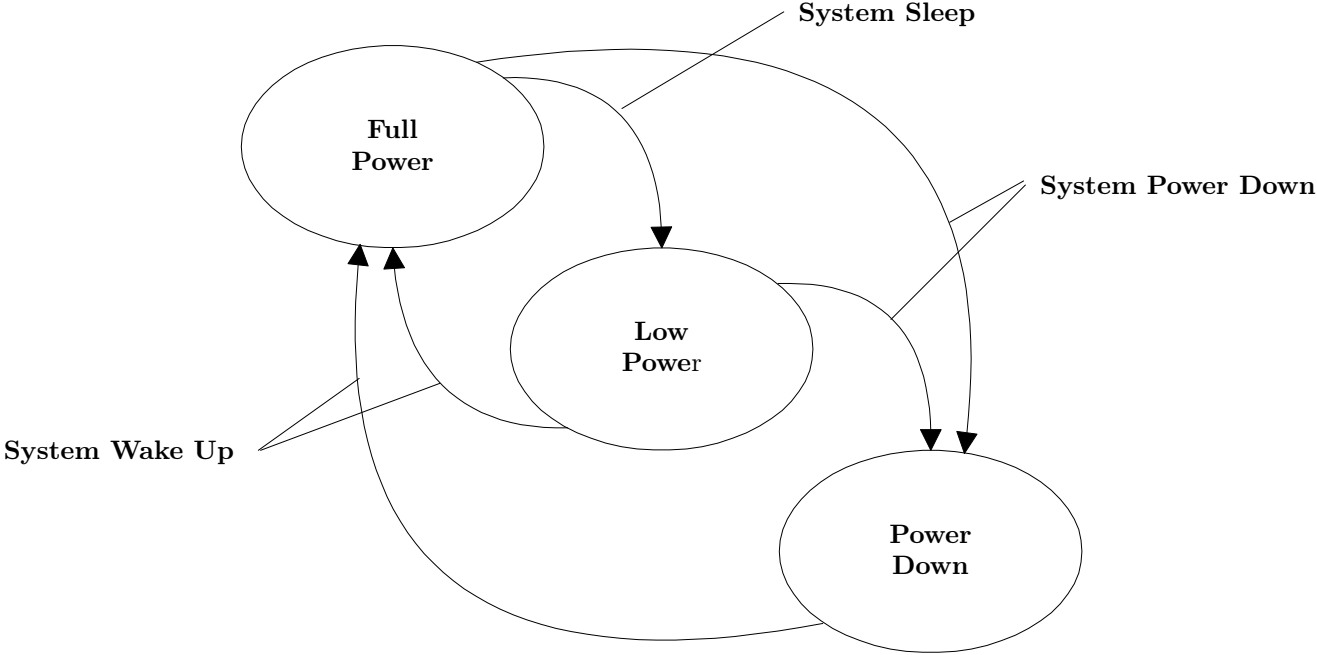


Figure 4.1: System Power States

## 4.6 Buffered Bytes

The following usages provide a standard way of defining the operation of a buffered-byte field where the number of valid bytes in the field is less than the total number of bytes in the field and the vendor does not define a NoOp value to mark unused bytes.

When declaring a buffered-byte field, the global item **Report Size** should always be set to 8 (for byte cells), and the **Report Count** should be equal to the maximum size of the buffer to be transferred.

Usage Name	Usage Type	Description
<b>Counted Buffer</b>	CL	Used with buffered-byte data to indicate the number of valid bytes in the buffered-byte field. This collection always contains two field declarations: Byte Count and a usage that names the purpose of the buffered-byte field. The <b>Main</b> item associated with the purpose usage will always have the Buffered Bytes attribute set.
Byte Count	DV	Defines a report field that indicates the number of meaningful data bytes in an associated buffered-byte field.

## 4.7 Direction Pads

A Direction Pad or D-Pad control is mechanically identical to a hatswitch, however for legacy reasons their data is interpreted as X and Y axes rather than as an angular direction.

D-pads are typically defined as a pair of X and Y axes that are contained in a logical Pointer collection. There are cases where an application may be interested in the raw D-pad data. The following usages are defined in a report descriptor as single bit fields that identify the current state of the position switches in the D-pad.

*Note: A device may declare a Pointer collection with X and Y axes, and D-pad usages for the same control. An application can determine which data format best suits it's needs.*

Usage Name	Usage Type	Description
D-pad Up	OOC	Indicates that top of a Direction Pad is pressed.
D-pad Down	OOC	Indicates that bottom of a Direction Pad is pressed.
D-pad Right	OOC	Indicates that right side of a Direction Pad is pressed.
D-pad Left	OOC	Indicates that left side of a Direction Pad is pressed.

## 4.8 Feature Notifications

It may be useful to alert the host that the contents of a Feature report have changed without redundantly declaring a usage in an Input report, especially if the changes are only occasional. The Feature Notification usage provides a mechanism for doing this.

Usage Name	Usage Type	Description
Feature Notification	DV	<p>This usage is declared in an Input report and is used as a notification to the host that the contents of a specific Feature report has changed.</p> <p>If Report IDs are declared in the device's report descriptor then the <b>Report Size</b> of the Feature Notification must be greater than 1, and the Feature Notification field contains the Report ID of the Feature report that whose contents have changed. A zero value indicates that no Feature reports have changed. Multiple Feature report IDs can be reported in a single Input report by declaring the <b>Report Count</b> to be greater than 1.</p> <p>If Report IDs are not declared in the device's report descriptor then the <b>Report Size</b> of the Feature Notification equals 1, and the Input report field equals 1 if the Feature report contents have changed. A zero value indicates that no Feature reports have changed.</p> <p>When a valid Feature Notification is received, the host must issue a <code>GetReport(Feature)</code> request to the device with the appropriate report ID.</p>

## 4.9 Software Flow Controls

The following usages provide standard controls to break into the current operation of the system.

Usage Name	Usage Type	Description
System Break	OSC	Asserted when the intended action is to acquire the attention of the operating system in order to control applications. This operation could interrupt all running applications.
System Debugger Break	OSC	Asserted when the intended action is to break into the operating system debugger. If no OS debugger is running, the control is ignored.
Application Break	OSC	Asserted when the intended action is to acquire the attention of an application. This operation interrupts only the foremost running application.
Application Debugger Break	OSC	Asserted when the intended action is to break into the application debugger. If no application debugger is running, the control is ignored.

## 4.10 System Display Controls

Many systems currently support multiple displays. Of special note are portable systems with captive displays that may be connected to external displays. The following usages provide standard controls for common display control functions:

Usage Name	Usage Type	Description
System Display Invert	OSC	Causes the display to render in inverted colors.
System Display Internal	OSC	Causes the system to use the captive display as the primary display.
System Display External	OSC	Causes the system to use the external display as the primary display.
System Display Both	OSC	Causes the system to use both internal and external displays as the primary display.
System Display Dual	OSC	Causes the system to use both internal and external displays as primary and secondary displays.
System Display Toggle Int/Ext Mode	OSC	Causes a system to step between the modes as described above: <ul style="list-style-type: none"><li>• System Display Internal</li><li>• System Display External</li><li>• System Display Both</li></ul>
System Display Swap Primary/Secondary	OSC	Causes a system using two displays in dual mode to swap the primary and secondary displays.
System Display Toggle LCD Autoscale	OSC	Causes a system with a non-scaleable geometry, such as an LCD, to scale the display image to fit the physical geometry of the display.
System Display Rotation Lock Button	OOC	Indicates the current state of a system display rotation lock on/off momentary push button. State must be reported once for every button press.
System Display Rotation Lock Slider Switch	OOC	Indicates the absolute value for the state of system display rotation lock. State must be reported when it goes from 0 to 1 as well as from 1 to 0.

## 4.11 Computer Sensor Controls

Advances in the enthusiast class personal computer has led to the development of intelligent water cooling devices, chassis, and power supplies that provide addition status, monitoring, and control information to the user on the health and capabilities of their system. In addition to the raw sensor data, the sensors can be grouped into logical thermal and control zones to represent different operating areas within the device (e.g., thermal zones around the processor, hard drives, or PCI-E slots).

Usage Name	Usage Type	Description
<b>Sensor Zone</b>	CL	A logical collection that represents a grouping of sensors or other controls within a device that control a common physical region or physical function within the device when one or more physical regions exist.
RPM	DV	Indicates or controls the current revolutions per minute of a rotating device (e.g., fan). This usage shall be represented as units of rotations per minute.
Coolant Level	DV	Indicates the current level of coolant in its coolant containment container. This usage shall be represented as a percentage with a logical minimum of zero and a logical maximum of 100.
Coolant Critical Level	SV	Indicates the level at which the coolant is below a critical threshold at which the potential for damage exists.
Coolant Pump	US	This collection allows the usages that it contains to be associated with a coolant pump. In this collection one or more RPM usages are found.
<b>Chassis Enclosure</b>	CL	This collection represents the dimensions of a computer chassis. This collection shall contain an X, Y, and Z usage.



## 4.12 Wireless Radio Controls

Usage Name	Usage Type	Description
Wireless Radio Button	OOC	Indicates the current state of a wireless on/off momentary push button. State must be reported once for every button press.
Wireless Radio LED	OOC	Indicates the current state of wireless communication to the user. This will reflect the state of the overall system radio state.
Wireless Radio Slider Switch	OOC	Indicates the absolute value for the state of radio communications. State must be reported when it goes from 0 to 1 as well as 1 to 0.

## 4.13 Generic Controls

Usage Name	Usage Type	Description
Control Enable	DF	<p>Enable or disable the controls within the current logical collection. A value of 1 indicates that the controls in the same logical collection are enabled. A value 0 indicates they are disabled.</p> <p>When disabled, controls that are declared without the <code>NULL</code> attribute will keep their last values. Controls that declare the <code>NULL</code> attribute will be in a <code>NULL</code> state without further state changes. Also, such controls that are not in <code>NULL</code> that get disabled will move to <code>NULL</code> and input controls should generate a report to that effect. Feature and output reports will change silently.</p>

## 4.14 Spatial Controls

A spatial controller is a handheld input device that users move freely through space to provide position and orientation input. The spatial controller's orientation is represented as a rotation relative to its neutral orientation. The neutral orientation is the controller's orientation when sitting flat on a surface pointing forward along the negative Y axis, with gravity pointing down along the positive Z axis and with X increasing from the Controller's left to its right. The *forward* direction in the XY plane is unspecified and implementation-specific. This rotation is expressed as a unit quaternion (Qx/Qy/Qz/Qw).

If the Spatial Controller reports position in addition to orientation, the translation axes must correspond to the rotation axes.

*Note: Expressing a rotation as a quaternion avoids ambiguity about the order in which the host must apply the three axis rotations. Many applications also choose to use quaternions instead of Euler angles in their own logic to avoid gimbal lock. Surfacing quaternions directly to such apps from the device's firmware reduces precision loss caused by the conversion from Rx/Ry/Rz.*

Usage Name	Usage Type	Description
Qx	DV	The X component of a unit quaternion, representing a rotation in space about a unit vector. Rotations represented by quaternion report values follow the right-hand rule.
Qy	DV	The Y component of a unit quaternion, representing a rotation in space about a unit vector. Rotations represented by quaternion report values follow the right-hand rule.
Qz	DV	The Z component of a unit quaternion, representing a rotation in space about a unit vector. Rotations represented by quaternion report values follow the right-hand rule.
Qw	DV	The W component of a unit quaternion, representing a rotation in space about a unit vector. Rotations represented by quaternion report values follow the right-hand rule.
Index Trigger	MC/DV	The pressure applied to an input device's index-finger trigger, indicating that the user is pulling their index finger. This usage can be a DV for an analog trigger or an MC for a digital trigger.
Palm Trigger	MC/DV	The pressure applied to an input device's palm trigger, indicating that the user is closing their fist tightly around the controller. This usage can be a DV for an analog trigger or an MC for a digital trigger.
<b>Thumbstick</b>	CP	An input device's two-axis thumb-operated control stick. The thumbstick's X value increases from left to right and its Y value increases from bottom to top. A thumbstick is typically a rotational motion sensor. However, for legacy reasons, it is defined using linear axes.

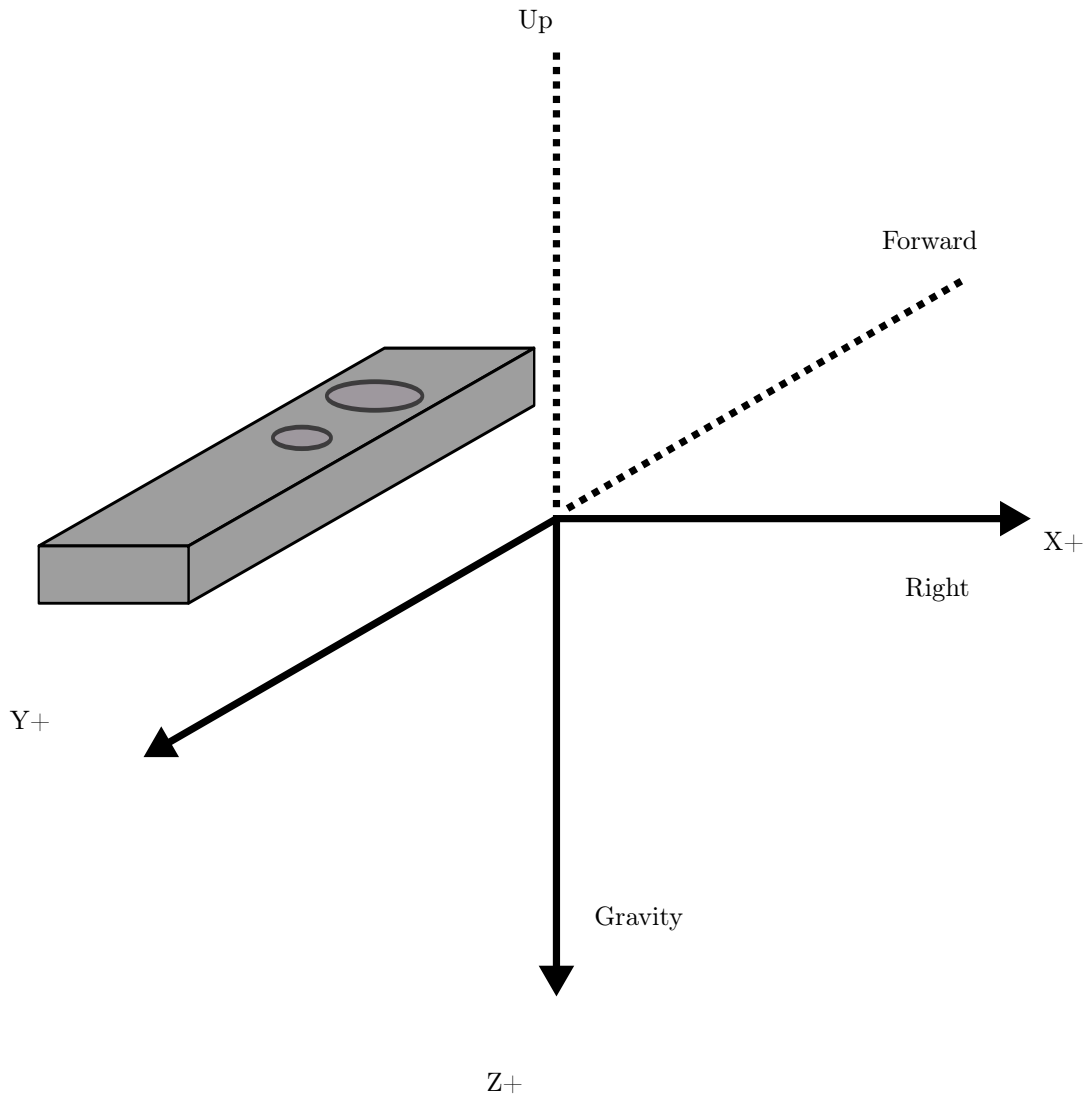


Figure 4.2: Spatial Controller Orientation

## 4.15 Dockable Devices

In many computing systems, there are cases where a potentially non-HID **Dockable Devices** can be physically attached to a system or another device - whether for storage, to charge, or for ergonomic usage of the device relative to the needs of the computing system. While modern operating systems may be able to detect some elements of this attachment through device enumeration or ACPI information, there are use cases where rich information specific to the state of the **Dockable Device's** attachment to the system can be valuable.

For example, a digital pen which only communicates with a digitizer within a short range may not be able to communicate that it has been attached to a pen holder on the device for the system to update UI showing the pen has been connected. Other representations may disable a **Dockable Device's** connection to the host when placed in a dock to allow for reduced power consumption.

In other cases, the **Device Dock** itself may have access to information that the **Dockable Device** may not. In a system with a horizontal display, for example, it may be possible for a sensor to detect exactly where a **Dockable Device** or other object has been placed relative to the display, so that the system may adjust placement of UI around it, while the object itself is incapable of detecting or reporting this information.

Usage Name	Usage Type	Description
Device Dock	CA	A device that reports the presence of a <b>Dockable Device</b> physically attached to the system.
Dockable Device	CA	A device describing a <b>Dockable Device</b> that <i>can</i> be physically attached to the system.
Dockable Device Unique ID	DV	Specifies the unique ID identifying the device which has been docked.  This is an <i>optional</i> Usage - if the <b>Dockable Device</b> does not have a <b>Dockable Device Unique ID</b> or the <b>Device Dock</b> is not capable of reading the <b>Dockable Device Unique ID</b> from the device, this would not be provided. If provided, the <b>Dockable Device Unique ID</b> must be unique for the USB-IF VendorId, specified by <b>Dockable Device Vendor ID</b> below. For example, this could contain the unique serial number of the <b>Dockable Device</b> or a product identifier if a serial number cannot be provided.
Dockable Device Vendor ID	DV	Specifies the USB-IF VendorId of the <b>Dockable Device</b> , used in combination with <b>Dockable Device Unique ID</b> to uniquely identify the device.  This is an <i>optional</i> Usage. If provided, this must be a 16-bit value.
Dockable Device Primary Usage Page	DV	Specifies the UsagePage of the primary top-level collection of the Dockable Device (in the case of a complex HID device), to allow the system to understand which Dockable Device has been docked.  This is an <i>optional</i> Usage which can be useful in cases where the <b>Dockable Device</b> is not connected to the system, or is not capable of reporting a unique serial number, in conjunction with <b>Dockable Device Primary Usage ID</b> . For a <b>Dockable Device</b> with multiple HID top-level collections, the value of this Usage is defined by the vendor.
Dockable Device Primary Usage ID	DV	Specifies the UsageId of the primary top-level collection of the <b>Dockable Device</b> (in the case of a complex HID device).  This is an <i>optional</i> Usage, used in conjunction with <b>Dockable Device Primary Usage Page</b> . For a <b>Dockable Device</b> with multiple HID top-level collections, the value of this Usage is defined by the vendor.

Dockable Device Docking State	DF	<p>A bit that indicates if the <b>Dockable Device</b> is currently attached to the system.</p> <p>This is a <i>required</i> Usage. A report with this bit set would indicate the <b>Dockable Device</b> is physically attached to the system. A report with this bit cleared would indicate the <b>Dockable Device</b> has been physically detached from the system.</p>
Dockable Device Display Occlusion	CL	<p>A physical collection describing what portion of a display is occluded by the <b>Device Dock</b>.</p> <p>This collection is <i>optional</i> – it would not be reported if the supported <b>Dockable Device</b> cannot occlude the display. This collection could include values like X, Y, Width (in mm), Height (in mm), Azimuth, etc. for rectangular-shaped occlusions. Future Usages could support other <b>Dockable Device</b> shapes.</p>
Dockable Device Object Type	DV	<p>An enum which specifies the type of object which is being docked.</p> <p>This is an <i>optional</i> usage. It is possible that there could be multiple Dockable Objects placed relative to the display that also include different objects types such as:</p> <ul style="list-style-type: none"> <li>• 0: Unspecified.</li> <li>• 1: HID Device.</li> <li>• 2: Display.</li> <li>• 3: NFC Device.</li> </ul>

## 5 Simulation Controls Page (0x02)

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Flight Simulation Device</b>	CA	<a href="#">5.2</a>
02	<b>Automobile Simulation Device</b>	CA	<a href="#">5.3</a>
03	<b>Tank Simulation Device</b>	CA	<a href="#">5.4</a>
04	<b>Spaceship Simulation Device</b>	CA	<a href="#">5.2</a>
05	<b>Submarine Simulation Device</b>	CA	<a href="#">5.5</a>
06	<b>Sailing Simulation Device</b>	CA	<a href="#">5.5</a>
07	<b>Motorcycle Simulation Device</b>	CA	<a href="#">5.6</a>
08	<b>Sports Simulation Device</b>	CA	<a href="#">5.1</a>
09	<b>Airplane Simulation Device</b>	CA	<a href="#">5.2</a>
0A	<b>Helicopter Simulation Device</b>	CA	<a href="#">5.2</a>
0B	<b>Magic Carpet Simulation Device</b>	CA	<a href="#">5.7</a>
0C	<b>Bicycle Simulation Device</b>	CA	<a href="#">5.6</a>
0D-1F	<i>Reserved</i>		
20	<b>Flight Control Stick</b>	CA	<a href="#">5.2</a>
21	<b>Flight Stick</b>	CA	<a href="#">5.2</a>
22	<b>Cyclic Control</b>	CP	<a href="#">5.2</a>
23	<b>Cyclic Trim</b>	CP	<a href="#">5.2</a>
24	<b>Flight Yoke</b>	CA	<a href="#">5.2</a>
25	<b>Track Control</b>	CP	<a href="#">5.4</a>
26-AF	<i>Reserved</i>		
B0	Aileron	DV	<a href="#">5.2</a>
B1	Aileron Trim	DV	<a href="#">5.2</a>
B2	Anti-Torque Control	DV	<a href="#">5.2</a>
B3	Autopilot Enable	OOC	<a href="#">5.2</a>
B4	Chaff Release	OSC	<a href="#">5.2</a>
B5	Collective Control	DV	<a href="#">5.2</a>
B6	Dive Brake	DV	<a href="#">5.2</a>
B7	Electronic Countermeasures	OOC	<a href="#">5.2</a>
B8	Elevator	DV	<a href="#">5.2</a>
B9	Elevator Trim	DV	<a href="#">5.2</a>
BA	Rudder	DV	<a href="#">5.2</a>
BB	Throttle	DV	<a href="#">5.2</a>
BC	Flight Communications	OOC	<a href="#">5.2</a>
BD	Flare Release	OSC	<a href="#">5.2</a>
BE	Landing Gear	OOC	<a href="#">5.2</a>
BF	Toe Brake	DV	<a href="#">5.2</a>
C0	Trigger	MC	<a href="#">5.2</a>
C1	Weapons Arm	OOC	<a href="#">5.2</a>
C2	Weapons Select	OSC	<a href="#">5.2</a>

C3	Wing Flaps	DV	5.2
C4	Accelerator	DV	5.3
C5	Brake	DV	5.3
C6	Clutch	DV	5.3
C7	Shifter	DV	5.3
C8	Steering	DV	5.3
C9	Turret Direction	DV	5.4
CA	Barrel Elevation	DV	5.4
CB	Dive Plane	DV	5.5
CC	Ballast	DV	5.5
CD	Bicycle Crank	DV	5.6
CE	Handle Bars	DV	5.6
CF	Front Brake	DV	5.6
D0	Rear Brake	DV	5.6
D1-FFFF	<i>Reserved</i>		

Table 5.1: Simulation Controls Page



## 5.1 Sports Simulation Device

Usages employed by Stick Devices and Exercise Machines are defined on the Sports Controls page. For details, see [Section 7 Sport Controls Page \(0x04\)](#)

Usage Name	Usage Type	Description
<b>Sports Simulation Device</b>	CA	This usage definition allows a device to be generally classified as one that uses standard controls found on a sports simulation device.

## 5.2 Flight Simulation Devices

Usage Name	Usage Type	Description
<b>Flight Simulation Device</b>	CA	This usage definition allows a device to be generally classified as one that uses the standard controls found on an airplane.
<b>Spaceship Simulation Device</b>	CA	This usage definition allows a device to be generally classified as one that uses standard controls found on a spaceship.
<b>Airplane Simulation Device</b>	CA	This usage definition allows a device to be generally classified as one that uses standard controls found on an airplane.
<b>Helicopter Simulation Device</b>	CA	This usage definition allows a device to be generally classified as one that uses standard controls found on a helicopter.
Aileron	DV	An aileron is one of two movable flaps on the wings of an airplane that can be used to control the plane's rolling and banking movements. In the zero position the ailerons are centered, positive values will move the right aileron up and the left aileron down, and negative values will have the opposite effect on the ailerons.
Aileron Trim	DV	Allows fine adjustment of the Aileron position. The zero position is the nominal position, positive values will move the right aileron up and the left aileron down, and negative values will have the opposite effect on the ailerons.
Anti-Torque Control	DV	This control mechanically behaves the same as rudder pedals; as one is pushed forward, the other pushes back. In a helicopter, this controls the pitch of the tail blade to spin the helicopter in place. The zero position is centered, positive values rotate right, and negative values rotate left.
Autopilot Enable	OOC	This control enables or disables an airplane's autopilot. This should be a toggle switch, but it is typically implemented as a pushbutton.
Chaff Release	OSC	Chaff is strips of metal, foil, or glass fiber with a metal content, cut into various lengths and having varying frequency responses. It is used to reflect electromagnetic energy as a radar countermeasure. These materials, usually dropped from aircraft, also can be deployed from shells or rockets. Typically this a pushbutton that initiates a release of a fixed amount of material.
Collective Control	DV	This control is specifically for a helicopter. It controls the vertical acceleration or lift of the helicopter. The zero position is centered (level flight), positive values accelerate up, and negative values accelerate down.
<b>Cyclic Control</b>	CP	This control is specifically for a helicopter. A cyclic control is a stick between the pilot's legs that moves in two axes. It controls the swash plate, which in turn controls horizontal acceleration of the helicopter. The zero position is centered, positive Y values accelerate forward, and negative Y values accelerate backward. Positive X values accelerate right, and negative X values accelerate left. This collection will contain X and Y axes.
<b>Cyclic Trim</b>	CP	This control is specifically for a helicopter. Cyclic Trim allows fine adjustment of the cyclic position in two dimensions. The zero position is the nominal position, positive values adjust the baseline acceleration right or forward, and negative values adjust the baseline acceleration left or backward, respectively. This collection will contain X and Y axes.
Dive Brake	DV	A flap that can be extended on an aircraft to increase drag and reduce the speed of descent. It is typically implemented as a lever that generates a dimensionless value between no braking (0) and full braking.
Electronic Countermeasures	OOC	A pushbutton that enables electronic countermeasures. This is typically active radar jamming; however Chaff (radar) or Flare (infrared) can be invoked.

Elevator	DV	A movable control surface, usually attached to the horizontal stabilizer of an aircraft, that is used to produce motion up or down. The zero position is centered, positive values raise the elevator, and negative values lower the elevator.
Elevator Trim	DV	Elevator Trim allows fine adjustment of the Elevator position. The zero position is the nominal position, positive values are elevator offset up, and negative values are elevator offset down.
Flight Communications	OOC	In combat aircraft, a communication (comm) button is usually positioned under the index finger. Typically this is a two-position pushbutton where the first position enables communications with the crew and the second position enables the transmitter for communication external to the plane.
Flare Release	OSC	A flare is a device that produces a bright light for signaling, illumination, identification, or heat for infrared missile countermeasures. Typically this is a pushbutton that releases a fixed number of flares.
<b>Flight Control Stick</b>	CA	<p>A Flight Control Stick controls the Pitch and Roll of an airplane. It looks like a joystick. The stick may be pushed forward or pulled back to move the tail elevator down or up, respectively. Pushing forward causes the plane to nose down. Tilting the stick right and left alters the position of the ailerons. In the zero position the ailerons are centered, tilting the stick to the right will move the right aileron up and the left aileron down, and tilting the stick to the left direction will have the opposite effect on the ailerons.</p> <p>Mechanically, a stick presents two degrees of rotational freedom with approximately a <math>\pm 45^\circ</math> range. However, these axes are represented as Generic Desktop Page translational axes X (Roll) and Y (Pitch).</p>
<b>Flight Stick</b>	CA	A <b>Flight Stick</b> defines a class of device commonly used for flight simulator games. For a device to qualify as a <b>Flight Stick</b> , it must support at least two axes (Pitch and Roll), a trigger button, three additional buttons, and a hat switch. A <b>Flight Stick</b> is a functional subset of a <b>Flight Control Stick</b> .
Landing Gear	OOC	A control for raising or lowering an airplane's landing gear. This should be a toggle switch, but it is typically implemented as pushbutton.
Rudder	DV	The zero position is centered, positive values turn right, and negative values turn left.
Toe Brake	DV	A device for slowing or stopping the motion of an airplane when it is on the ground. Typically, Toe Brakes consist of two foot pedals that affect the left and right brakes, respectively. Control of the Toe Brakes can allow steering of the plane as well as braking when it is on the ground. An analog Toe Brake generates a dimensionless value between 0 and full scale. In some implementations, the Toe Brake can simply be a pushbutton (full on or off).
Throttle	DV	A valve that regulates the flow of a fluid, such as the valve in an internal-combustion engine that controls the amount of vaporized fuel entering the cylinders. A lever or pedal controlling such a valve generates a dimensionless value between 0 and full scale.
Trigger	MC	A lever pressed by the finger to release or activate a mechanism, typically used to discharge a firearm. However, a Trigger can be used for many devices. In combat airplanes the Trigger is usually positioned under the thumb; for a gun it would be positioned under the index finger. Typically this is implemented as a pushbutton.
Weapons Arm	OOC	This device is normally a covered toggle switch that must be selected to enable the weapons system.
Weapons Select	OSC	This device can either be a pushbutton that steps through the available weapons or a radio button that selects them individually.

Wing Flaps	DV	Wing flap controls are usually powered either hydraulically or by electric motors, and are used for low-speed control of an airplane. A flap generates a value between 0 and full extension.
<b>Flight Yoke</b>	CA	<p>A flight yoke (also called a control wheel) controls the pitch and roll of an airplane. It looks like a bow tie grasped by both hands. The yoke at which the pilot sits may be pushed forward or pulled back to move the tail elevator down or up, respectively. In the zero position the elevator is centered for level flight. Pushing forward on the yoke causes the plane to nose down and generates negative values. Pulling back on the yoke causes the plane to nose up and generates positive values.</p> <p>Rotating the yoke alters the position of the ailerons. In the zero position the ailerons are centered. Rotating the yoke in a clockwise direction will move the right aileron up and the left aileron down and generate incrementing values. Rotating the yoke in the counterclockwise direction will have the opposite effect on the ailerons and generate decrementing values.</p>

### 5.3 Automobile Simulation Devices

Usage Name	Usage Type	Description
<b>Automobile Simulation Device</b>	CA	This usage definition allows a device to be generally classified as one that uses the standard controls found in an automobile or truck.
Accelerator	DV	A device, especially the gas pedal of a motor vehicle, for increasing speed. An Accelerator is a dimensionless single degree-of-freedom dynamic value, where the range of values is from zero to maximum acceleration.
Brake	DV	A device for slowing or stopping motion, as of a vehicle, especially by contact friction. A Brake can be an On/Off Control or a dimensionless single degree-of-freedom dynamic value, where the range of values is from zero to maximum braking.
Clutch	DV	A device for disengaging the transmission of a vehicle to allow shifting of gears. A Clutch can be a generic button or a dimensionless single degree-of-freedom dynamic value, where the range of values is from zero to maximum clutch actuation.
Shifter	DV	A device for shifting gears in a vehicle. A Shifter is a specialized mechanical configuration of a radio button. A zero value is returned when the shifter is in the neutral position. Positive values indicate the forward gear and negative values indicate the reverse gear that the device is in.
Steering	DV	A steering wheel is a single degree-of-freedom device that rotates about an axis. The zero position is always the neutral or <i>straight ahead</i> position, with positive values turning clockwise and negative values turning counterclockwise. If the Coordinate Values Wrap attribute is set, the steering wheel can be turned past 360°.

## 5.4 Tank Simulation Devices

Usage Name	Usage Type	Description
<b>Tank Simulation Device</b>	CA	This usage definition allows a device to be generally classified as one that uses standard controls found in a tank or a treaded vehicle.
<b>Track Control</b>	CP	<p>A device for controlling the direction and velocity of a vehicle that is driven by tracks. There can be either two sticks with one degree of freedom or a single stick with two degrees of freedom:</p> <p>In the two-stick case, the neutral position is when the stick is centered (zero). Pushing the stick forward causes forward acceleration (positive values), and pulling it back causes reverse acceleration (negative values). The righthand and lefthand controls will affect the corresponding side of the vehicle.</p> <p>In the one-stick case, forward/backward acceleration works the same as in the two-stick case. However, right or left movement of the stick determines the amount of power applied to the respective track. When the stick is centered horizontally, equal amounts of power are applied to both tracks, generating a zero output value. Moving the stick to the right will generate positive values, and moving the stick to the left will generate negative values. A <b>Tank Track Control</b> is a dimensionless analog entity.</p>
Turret Direction	DV	This control determines the right-to-left positioning of the tank turret. A value of zero maintains the current orientation of the turret. A positive value turns the turret to the right and a negative value turns the turret to the left.
Barrel Elevation	DV	This control determines the elevation of the gun barrel in a turret. A value of zero maintains the current orientation of the barrel. A positive value raises the barrel and a negative value lowers the barrel.

## 5.5 Maritime Simulation Devices

Usage Name	Usage Type	Description
<b>Submarine Simulation Device</b>	CA	Allows a device to be generally classified as one that uses the standard controls of a submarine.
Dive Plane	DV	Dive planes control the vertical ascent or descent of the submarine under power. A zero value indicates level travel. Positive values indicate ascent, and negative values indicate descent. A Dive Plane is a dimensionless analog entity.
Ballast	DV	Ballast controls the vertical ascent or descent of the submarine. A zero value indicates level travel. Positive values indicate ascent, and negative values indicate descent. A Ballast is a dimensionless analog entity.
<b>Sailing Simulation Device</b>	CA	Allows a device to be generally classified as one that uses the standard controls of a sailboat.

## 5.6 Two-wheeled Simulation Devices

Usage Name	Usage Type	Description
<b>Motorcycle Simulation Device</b>	CA	Allows a device to be generally classified as one that uses the standard controls of a motorcycle.
<b>Bicycle Simulation Device</b>	CA	Allows a device to be generally classified as one that uses the standard controls of a bicycle.
Bicycle Crank	DV	A foot-operated assembly of pedals attached to a crank that is used for powering a bicycle. The reported value is the rate that the crank turns per minute.
Handle Bars	DV	A steering control, held in both hands, for a motorcycle or bicycle. A zero output value indicates that the direction of travel is straight ahead. Pulling back on the right side turns the vehicle to the right and generates a positive output. Pulling back on the left side turns the vehicle to the left and generates a negative output.
Front Brake	DV	Engages the front brake of the motorcycle to slow the vehicle. A Front Brake can be a generic button or a dimensionless single degree-of-freedom analog entity, where the range of values is from zero to maximum braking.
Rear Brake	DV	Engages the rear brake of the motorcycle to slow the vehicle. A Rear Brake can be a generic button or a dimensionless single degree-of-freedom analog entity, where the range of values is from zero to maximum braking.



## 5.7 Miscellaneous Simulation Devices

Usage Name	Usage Type	Description
<b>Magic Carpet Simulation Device</b>	CA	<p>Allows a device to be generally classified as one that uses the standard control of a magic carpet. This control is a bar, grasped by both hands, that controls the Yaw, Pitch and Roll of the carpet.</p> <p>The bar, at which the pilot sits, may be pushed forward or pulled back to cause the carpet to dive or rise, respectively. In the zero position, the carpet is in level flight. Pushing forward on the bar causes the carpet to nose down and generates negative values. Pulling back on the bar causes the carpet to nose up and generates positive values.</p> <p>Turning the bar turns the carpet. In the zero position, the carpet travels straight ahead. Pulling back on the right side turns the carpet to the right and generates positive values. Pulling back on the left side turns the carpet to the left and generates negative values.</p> <p>Rotating the bar rolls the carpet. In the zero position, the carpet travels level. Rotating the bar in a clockwise direction rolls the carpet to the right and generates positive values. Rotating the bar in the counterclockwise direction rolls the carpet to the left and generates negative values.</p>

## 6 VR Controls Page (0x03)

Virtual Reality controls depend on designators to identify the individual controls. Most of the following are usages are applied to the collections of entities that comprise the actual device.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Belt</b>	CA	<a href="#">6.1</a>
02	<b>Body Suit</b>	CA	<a href="#">6.1</a>
03	<b>Flexor</b>	CP	<a href="#">6.1</a>
04	<b>Glove</b>	CA	<a href="#">6.1</a>
05	<b>Head Tracker</b>	CP	<a href="#">6.1</a>
06	<b>Head Mounted Display</b>	CA	<a href="#">6.1</a>
07	<b>Hand Tracker</b>	CA	<a href="#">6.1</a>
08	<b>Oculometer</b>	CA	<a href="#">6.1</a>
09	<b>Vest</b>	CA	<a href="#">6.1</a>
0A	<b>Animatronic Device</b>	CA	<a href="#">6.1</a>
0B-1F	<i>Reserved</i>		
20	Stereo Enable	OOC	<a href="#">6.2</a>
21	Display Enable	OOC	<a href="#">6.2</a>
22-FFFF	<i>Reserved</i>		

Table 6.1: VR Controls Page

## 6.1 VR Control Devices

Usage Name	Usage Type	Description
<b>Belt</b>	CA	A Belt wraps around the user's waist. A tracker would be centered in the small of the user's back to identify the orientation of the user's hips.
<b>Body Suit</b>	CA	Generally classifies a device as one that uses the standard controls found in a Body Suit. A Body Suit typically has a large number of position sensors typically fixed to the major joints of the body, such as the ankles, knees, hips, shoulders, elbows, wrists and head, for measuring the angle and movement of the wearer's joints and limbs.
<b>Flexor</b>	CP	A Flexor describes the angle of bend of a joint or limb in the body. The designator is used to determine which joint a specific Flexor entity represents.
<b>Glove</b>	CA	A Glove reports the positions of the fingers. Up to 20 angular values can be reported. Designators are used to determine the degrees of freedom that the Glove device is capable of reporting.
<b>Head Tracker</b>	CP	A Head Tracker represents the position and/or orientation of the head in space. The axes are oriented such that, in the zero position, the user is looking from the positive Z axis to the negative Z axis. The positive Y axis is extends vertically from the top of the user's head.
<b>Head Mounted Display</b>	CA	A Head Mounted Display (HMD) presents the following parameters to the user: Vbrx, Vbry, and Vbrz. Stereo Enable and Display Enable are optional usages that can be included in an HMD collection.
<b>Hand Tracker</b>	CA	A Hand Tracker represents the position of the hand in space. A Hand Tracker attaches to the back of the hand. In the zero position, it is assumed that the hand is held upright with the extended thumb parallel to the Y axis and the fingers pointing in the negative Z direction.
<b>Oculometer</b>	CA	An Oculometer identifies the direction in which the eye is looking in rotation about the X and Y axes. The designator for an Oculometer is always Eye.
<b>Vest</b>	CA	A Vest wraps around the user's chest and abdomen. A tracker would be placed on the user's back between the shoulder blades.
<b>Animatronic Device</b>	CA	<p>An input device for the animation of mechanical or Computer Graphic Image <i>electronic</i> puppets. An animatronic device is engineered to fit a puppeteer's or performer's body (and/or head and/or face) and comfortably allow a wide range of physical freedom.</p> <p>An Animatronic Device measures the angle and movement of the wearer's joints and limbs, which are then translated into the motion of a puppet, allowing the puppet to mimic the wearer's movements. There is not necessarily a 1:1 mapping of human to puppet controls. A puppeteer's arm may be used to control the movement of an elephant's trunk, or hand controls may be used to control facial expressions. Designators are used to determine which puppeteer joint is being tracked. The controlling application will map these inputs to the electronic or mechanical device.</p>

## 6.2 VR Controls

Usage Name	Usage Type	Description
Stereo Enable	OOC	Selects the display mode of the HMD. A value of 0 selects monoscopic mode and 1 selects stereoscopic mode.
Display Enable	OOC	Enables the HMD video output. A value of 0 turns off the display and 1 turns it on.

## 7 Sport Controls Page (0x04)

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Baseball Bat</b>	CA	<a href="#">7.1</a>
02	<b>Golf Club</b>	CA	<a href="#">7.1</a>
03	<b>Rowing Machine</b>	CA	<a href="#">7.2</a>
04	<b>Treadmill</b>	CA	<a href="#">7.2</a>
05-2F	<i>Reserved</i>		
30	Oar	DV	<a href="#">7.2</a>
31	Slope	DV	<a href="#">7.2</a>
32	Rate	DV	<a href="#">7.2</a>
33	Stick Speed	DV	<a href="#">7.1</a>
34	Stick Face Angle	DV	<a href="#">7.1</a>
35	Stick Heel/Toe	DV	<a href="#">7.1</a>
36	Stick Follow Through	DV	<a href="#">7.1</a>
37	Stick Tempo	DV	<a href="#">7.1</a>
38	<b>Stick Type</b>	NAry	<a href="#">7.1</a>
39	Stick Height	DV	<a href="#">7.1</a>
3A-4F	<i>Reserved</i>		
50	Putter	Sel	<a href="#">7.1</a>
51	1 Iron	Sel	<a href="#">7.1</a>
52	2 Iron	Sel	<a href="#">7.1</a>
53	3 Iron	Sel	<a href="#">7.1</a>
54	4 Iron	Sel	<a href="#">7.1</a>
55	5 Iron	Sel	<a href="#">7.1</a>
56	6 Iron	Sel	<a href="#">7.1</a>
57	7 Iron	Sel	<a href="#">7.1</a>
58	8 Iron	Sel	<a href="#">7.1</a>
59	9 Iron	Sel	<a href="#">7.1</a>
5A	10 Iron	Sel	<a href="#">7.1</a>
5B	11 Iron	Sel	<a href="#">7.1</a>
5C	Sand Wedge	Sel	<a href="#">7.1</a>
5D	Loft Wedge	Sel	<a href="#">7.1</a>
5E	Power Wedge	Sel	<a href="#">7.1</a>
5F	1 Wood	Sel	<a href="#">7.1</a>
60	3 Wood	Sel	<a href="#">7.1</a>
61	5 Wood	Sel	<a href="#">7.1</a>
62	7 Wood	Sel	<a href="#">7.1</a>
63	9 Wood	Sel	<a href="#">7.1</a>
64-FFFF	<i>Reserved</i>		

Table 7.1: Sport Controls Page

## 7.1 Stick Devices

Stick devices are used in applications in which the user swings one object to make contact with another. Typical examples are a baseball bat and a golf club. These devices sense various quantities at the point of impact to determine the direction that the target (struck) object will go. The target object is a sphere. The Stick usages Speed, Face Angle, Heel/Toe, Follow Through, Tempo, and Height identify the measurement quantities.

Usage Name	Usage Type	Description
<b>Baseball Bat</b>	CA	Primary input device for baseball simulation applications. Normally consists of a collection of Stick usages.
<b>Golf Club</b>	CA	Primary input device for golf simulation applications. Normally consists of a collection of Stick usages.
Stick Speed	DV	The velocity with which the stick strikes the target object. This can be expressed as collection of velocity values to provide a direction, or as an absolute magnitude where the Stick Face Angle provides the direction.
Stick Face Angle	DV	The direction in which the stick strikes the target object. In a golf simulation, this will be the horizontal angle and the vertical angle will be determined by the <b>Stick Type</b> . For Baseball Bats and other stick devices the direction is expressed as a three-dimensional vector.
Stick Heel/Toe	DV	Identifies the contact point relative to the striking surface. This helps to identify the <i>sweet spot</i> . This is reported as a relative value where zero is the sweet spot, positive values are away from the user, and negative values are towards the user.
Stick Follow Through	DV	In a golf simulation, the user strikes the ball, swings the club forward over the shoulders, then brings the club back to the tee. Stick Follow Through is a measure of the time that this process takes. Other stick devices may provide this parameter as well.
Stick Tempo	DV	In a golf simulation, the user starts the swing at the ball, swings the club back over the shoulders, then strikes the ball. Stick Tempo is a measure of the time that this process takes. Other stick devices may provide this parameter as well.
<b>Stick Type</b>	NAry	An array that identifies the type of golf club used.
Irons 1 – 11, Woods 1, 3, 5, 7, 9, Sand Wedge, Loft Wedge, Power Wedge, and Putter	Sel	Golf club stick types. Stick type determines the stick face angle.
Stick Height	DV	Height of contact point above the ground for stick device.

## 7.2 Exercise Machines

Bicycles can be found in [Section 5.6 Two-wheeled Simulation Devices](#)

Usage Name	Usage Type	Description
<b>Rowing Machine</b>	CA	An exercise device that simulates rowing a boat. Usages typically found in this collection are Oars and Rate. Rate is typically expressed in strokes per minute.
Oar	DV	Rowing repetition rate in strokes per minute. Left, right and twohanded oars are distinguished with designators.
<b>Treadmill</b>	CA	An exercise device consisting of an endless moving belt on which a person can walk or jog while remaining in one place. Usages typically found in this collection are Slope and Rate. The Rate is typically expressed in strokes per minute.
Rate	DV	Rate in miles per hour.
Slope	DV	Slope is measured in degrees. Positive angles are uphill, negative angles are downhill, and 0° is level.

## 8 Game Controls Page (0x05)

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>3D Game Controller</b>	CA	<a href="#">8.1</a>
02	<b>Pinball Device</b>	CA	<a href="#">8.2</a>
03	<b>Gun Device</b>	CA	<a href="#">8.3</a>
04-1F	<i>Reserved</i>		
20	<b>Point of View</b>	CP	<a href="#">8.1</a>
21	Turn Right/Left	DV	<a href="#">8.1</a>
22	Pitch Forward/Backward	DV	<a href="#">8.1</a>
23	Roll Right/Left	DV	<a href="#">8.1</a>
24	Move Right/Left	DV	<a href="#">8.1</a>
25	Move Forward/Backward	DV	<a href="#">8.1</a>
26	Move Up/Down	DV	<a href="#">8.1</a>
27	Lean Right/Left	DV	<a href="#">8.1</a>
28	Lean Forward/Backward	DV	<a href="#">8.1</a>
29	Height of POV	DV	<a href="#">8.1</a>
2A	Flipper	MC	<a href="#">8.2</a>
2B	Secondary Flipper	MC	<a href="#">8.2</a>
2C	Bump	MC	<a href="#">8.2</a>
2D	New Game	OSC	<a href="#">8.2</a>
2E	Shoot Ball	OSC	<a href="#">8.2</a>
2F	Player	OSC	<a href="#">8.2</a>
30	Gun Bolt	OOC	<a href="#">8.3</a>
31	Gun Clip	OOC	<a href="#">8.3</a>
32	<b>Gun Selector</b>	NAry	<a href="#">8.3</a>
33	Gun Single Shot	Sel	<a href="#">8.3</a>
34	Gun Burst	Sel	<a href="#">8.3</a>
35	Gun Automatic	Sel	<a href="#">8.3</a>
36	Gun Safety	OOC	<a href="#">8.3</a>
37	<b>Gamepad Fire/Jump</b>	CL	<a href="#">8.4.1</a>
38-38	<i>Reserved</i>		
39	<b>Gamepad Trigger</b>	CL	<a href="#">8.4.1</a>
3A	Form-fitting Gamepad	SF	<a href="#">8.4.1</a>
3B-FFFF	<i>Reserved</i>		

Table 8.1: Game Controls Page



## 8.1 3D Game Controller

The following controls support first-person games or those that are played through the eyes of the character that represents the player in the 3D world.

Usage Name	Usage Type	Description
<b>3D Game Controller</b>	CA	A collection of 3D movement usages.
<b>Point of View</b>	CP	A collection of rotational axes (Rx, Ry, and Rz) that represent the orientation of the user's head in 3D space. If applied to a Hat Switch, only the Rz (Yaw) axis will be controlled.
Turn Right/Left	DV	Identifies the horizontal facing direction of the player's hips (Rz = Yaw). Turn Right/Left is a relative value where 0° is straight ahead, positive values turn right, and negative values turn left. The rate of rotation is determined by the application.
Pitch Forward/Backward	DV	Identifies the vertical facing direction of the player's hips (Rx = Pitch). Pitch Right/Left is a relative value where 0° is a vector pointing up from the players hips to the players head, positive values bend back, and negative values bend forward. The rate of rotation is determined by the application.
Roll Right/Left	DV	Identifies the vertical facing direction of the player's hips (Ry = Roll). Roll Forward/Backward is a relative value where 0° is a vector pointing up from the players hips to the players head, positive values lean left, and negative values lean right. The rate of rotation is determined by the application.
Move Right/Left	DV	This control allows the player to sidestep or move right and left without changing the orientation of the hips. Move Right/Left is a relative value where 0 is no lateral motion, positive values move right, and negative move left. The rate of movement is determined by the application.
Move Forward/Backward	DV	This control allows the player to move forward and backward in the direction (yaw) the hips are facing. Move Forward/Backward is a relative value where 0 is no motion, positive values move backward, and negative move forward. <i>(Note: These directions may appear counter-intuitive but they are consistent with the HID orientation conventions.)</i> The rate of movement is determined by the application.
Move Up/Down	DV	This control allows the player to move up and down. It is assumed that the player can fly, is swimming, or is at a ladder or a climbable wall. Move Up/Down is a relative value where 0 is no motion, positive values move down, and negative move up. <i>(Note: These directions may appear counter-intuitive but they are consistent with the HID orientation conventions.)</i> The rate of movement is determined by the application.
Lean Right/Left	DV	This control allows the player to lean right and left from the hips, without changing the orientation of the hips, for example, to look around a corner. Lean Right/Left is a relative value where 0 is no lateral motion, positive values move right, and negative move left. The rate of movement is determined by the application.
Lean Forward/Backward	DV	This control allows the player to lean forward and backward from the hips in the direction (yaw) the hips are facing. Lean Forward/Backward is a relative value where 0 is no motion, positive values move backward, and negative move forward. <i>(Note: These directions may appear counter-intuitive but they are consistent with the HID orientation conventions.)</i> The rate of movement is determined by the application.

Height of POV	DV	This control allows the player to stand, squat, and crawl. Height of POV is a relative value where 0 is the normal standing position and positive values lower the player's Point Of View. The maximum value as indicated by Logical Maximum is the crawling position, the median positive value is the squatting position, and negative values indicate the player is standing on tiptoes or flying. <i>(Note: These directions may appear counter-intuitive but they are consistent with the HID orientation conventions.)</i>
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## 8.2 Pinball Device

Pinball is a game played on a device in which the player operates a plunger to shoot a ball down or along a slanted surface that has obstacles and targets.

Usage Name	Usage Type	Description
<b>Pinball Device</b>	CA	A collection of usages representing the controls of a pinball game.
Flipper	MC	A button that actuates a bar that swings around a pivot to change the direction of the ball. A pair of right and left flippers normally resides at the near end of the table.
Secondary Flipper	MC	A button that actuates a bar that swings around a pivot to change the direction of the ball. Secondary flippers normally reside on the sides halfway up the table.
Bump	MC	A control that indicates that the flipper assembly has been shoved by the player to change the direction of the ball. This can be as simple as a switch or as complex as a 3D force vector.
New Game	OSC	A button that terminates any current game and reinitializes for a new game.
Shoot Ball	OSC	A control that indicates that the player has placed the ball into play. This can be as a switch or a force vector.
Player	OSC	A button that cycles through the number of players supported by the game.

## 8.3 Gun Device

A Gun Device is used in battle and war game simulations.

Usage Name	Usage Type	Description
<b>Gun Device</b>	CA	A collection of Gun usages that describes a hand-held projectile weapon.
Gun Bolt	OOC	A control that indicates the state of the gun bolt. A value of 1 indicates that the bolt is locked and ready to fire, and 0 indicates that the bolt is open, ready for the next shell.
Gun Clip	OOC	A control that indicates whether the gun clip is inserted. A value of 1 indicates that the clip is inserted, and 0 indicates that the clip is missing.
<b>Gun Selector</b>	NArY	This control identifies the firing mode of the weapon. Typically it is a mutually exclusive set of usages for single shot, burst, and fully automatic firing that are presented as an array input.
Gun Single Shot	Sel	Selects a single shot each time the trigger is pulled.
Gun Burst	Sel	Selects a short burst (three shots) each time the trigger is pulled.
Gun Automatic	Sel	Places the gun in fully automatic mode where it will fire continuously while the trigger is pulled.
Gun Safety	OOC	A control that indicates whether safety is enabled. A value of 1 indicates that the gun is enabled to fire, and 0 indicates that gun will not fire when the trigger is pulled.

## 8.4 Gamepads

The following Usages are targeted at gamepads however they can be used for any devices.

Gamepads use Start and Select buttons allow simple menu control. Select allows auser to linearly step through application options. If an option can be varied (i.e. volume, game speed, etc.) then the D-pad is typically used to modify it's value. A user indicates the final acceptance of an option by pressing Start. See [Section 4 Generic Desktop Page \(0x01\)](#) for the Start and Select button usage definitions.

Gamepad recommendations:-

1. All gamepad controls should have associated Physical descriptors.
2. If a gamepad control is labeled an associated String descriptor should be declared.

### 8.4.1 Gamepad Button Collections

Usages in the Gamepad Button Collections are assigned from the Button Page where Button 1 is the easiest for the user to access. Ideally, Button 1 is under the users finger when it is at rest. Button 2 is the next easiest to access and so on. The default gamepad is assumed to have the D-pad under the users left thumb and the Fire/Jump buttons under the right thumb.

The individual Gamepad Button collections can also support *chorded* commands. A Chorded command is invoked by simultaneously pressing multiple buttons with multiple fingers. By separating the buttons into thumb and index finger groups it will be possible for an application to identify whether a gamepad can support chorded commands.

An application should assume that if more than one button is pressed (true) in a collection that only the first button pressed is true. Or the lowest Button (Usage ID) is pressed if two or more buttons in the same collection become true in the same report.

Gamepad Fire/Jump and Trigger buttons are defined with the following conventions: Button 0 is the primary (or easiest to access) button, Button 1 is the secondary button, Button 3 is the tertiary button, and so on. Designators can be applied if more detail is required.

Usage Name	Usage Type	Description
<b>Gamepad Fire/Jump</b>	CL	A collection of gamepad buttons controlled by the user's thumb.
<b>Gamepad Trigger</b>	CL	A collection of gamepad buttons controlled by the user's index fingers.
Form-fitting Gamepad	SF	Indicates that the Gamepad is form-fitting (e.g. to a mobile device). <ul style="list-style-type: none"><li>• Value of 1 means that the Gamepad is form-fitting.</li><li>• Value of 0 means that the Gamepad is not form-fitting.</li></ul>

## 9 Generic Device Controls Page (0x06)

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Background/Nonuser Controls</b> [4] [65]	CA	9.1
02-1F	<i>Reserved</i>		
20	Battery Strength	DV	9.2
21	Wireless Channel	DV	9.2
22	Wireless ID	DV	9.2
23	Discover Wireless Control	OSC	9.2
24	Security Code Character Entered	OSC	9.2
25	Security Code Character Erased	OSC	9.2
26	Security Code Cleared	OSC	9.2
27	Sequence ID [5]	DV	9.1
28	Sequence ID Reset [5]	DF	9.1
29	RF Signal Strength [5]	DV	9.1
2A	<b>Software Version</b> [32]	CL	9.3
2B	<b>Protocol Version</b> [32]	CL	9.3
2C	<b>Hardware Version</b> [32]	CL	9.3
2D	Major [32]	SV	9.3
2E	Minor [32]	SV	9.3
2F	Revision [32]	SV	9.3
30	<b>Handedness</b> [40]	NAry	9.4
31	Either Hand [40]	Sel	9.4
32	Left Hand [40]	Sel	9.4
33	Right Hand [40]	Sel	9.4
34	Both Hands [40]	Sel	9.4
35-3F	<i>Reserved</i>		
40	<b>Grip Pose Offset</b> [40]	CP	9.4
41	<b>Pointer Pose Offset</b> [40]	CP	9.4
42-FFFF	<i>Reserved</i>		

Table 9.1: Generic Device Controls Page

## 9.1 Background/Nonuser Controls

The current Consumer Page Consumer Control Collection is used to report status of a variety of controls and states such as media transport, application launch buttons, etc. . . The *Background/Nonuser Controls* collection is for device events that may occur when a user is not present. This will assist the host in separating events that imply user presence. This separation permits the host to respond to such events but not be required to do things such as change monitor power states or wake screen savers, etc. . .

Usage Name	Usage Type	Description
<b>Background/Nonuser Controls</b>	CA	Collection of controls that do not imply user presence. These controls will still wake a suspended host by canceling screen savers or other similar activities.

## 9.2 Device Controls

Usage Name	Usage Type	Description
Battery Strength	DV	The current battery status. Proportion of battery life remaining where <b>Logical Minimum</b> and <b>Logical Maximum</b> define the range. NULL values indicate unknown battery status.
Wireless Channel	DV	The logical wireless channel that a wireless device is using. Actual values depend on the wireless protocol used.
Wireless ID	DV	Uniquely identifies a wireless device in a wireless subsystem. Actual values depend on the wireless protocol used.
Discover Wireless Control	OSC	Initiates or enables discovery of nearby wireless devices.
Security Code Character Entered	OSC	Indicates that a single security code character was entered.
Security Code Character Erased	OSC	Indicates that a single security code character was erased.
Security Code Cleared	OSC	Indicates that the entire security code was erased.
Sequence ID	DV	Value increments with each output report to allow detection of missed packets when using a wireless medium. When value reaches Logical Maximum it cycles back to Logical Minimum.
Sequence ID Reset	DF	Flag is used in conjunction with Sequence ID to indicate that a new sequence starting at the Sequence ID Logical Minimum has begun.
RF Signal Strength	DV	The current battery status. Strength of wireless device signal where Logical Minimum and Logical Maximum define the range. NULL values indicate unknown signal strength.

*Note: The relationship between a Wireless Channel and a Wireless ID is unspecified. Either or both can be used by a device.*



### 9.3 Versioning

Usage Name	Usage Type	Description
<b>Software Version</b>	CL	This is a collection used for software version information. Typical use would be to indicate a software or firmware version in <code>major.minor.revision</code> format.  <i>Note: Version information for a device should be in the device descriptor. This version information is intended for attached devices where there is no associated descriptor.</i>
<b>Protocol Version</b>	CL	This is a collection used for protocol version information.
<b>Hardware Version</b>	CL	This is a collection used for hardware version information.
Major	SV	Major version number.
Minor	SV	Minor version number.
Revision	SV	Revision version number.

## 9.4 Device Grip Controls

Some controllers support equivalent operation in either hand, while other controllers are dedicated by their physical form to either left-hand or right-hand operation. For a dedicated left-hand or right-hand controller, the host OS will need to know the physical nature of the controller to avoid guessing at handedness with unnecessary heuristics. The Bias physical descriptor was originally meant to surface this type of fixed handedness information, but real-world HID parsers do not generally in practice support physical descriptors. These explicit usages enable controllers to self-describe handedness with feature reports, which is a more common mechanism.

Different controller models may have varying physical forms while sharing a common tracking technology. The host OS may use a common driver to track the physical position of a family of controllers that share a tracking technology, even though the relative positions of key points on the controller reported to application software may differ between controller models. Enabling a controller to self-describe the offset from its tracking origin to key parts of the controller enables a single host driver to support many related controllers.

Usage Name	Usage Type	Description
<b>Handedness</b>	NAry	The hand or hands in which a device is designed to be held during typical operation.
Either Hand	Sel	Held in a single hand, either left or right.
Left Hand	Sel	Held in just the left hand.
Right Hand	Sel	Held in just the right hand.
Both Hands	Sel	Held in both hands.
<b>Grip Pose Offset</b>	CP	The device's fixed transform in position and rotation of its grip pose <sup>2</sup> relative to its tracking pose <sup>1</sup> .
<b>Pointer Pose Offset</b>	CP	The device's fixed transform in position and rotation of its pointer pose <sup>3</sup> relative to its tracking pose <sup>1</sup> .

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<sup>1</sup>A device's **tracking pose** is the oriented point within its physical body that its tracking technology will locate when determining the controller's position and orientation. Depending on the host OS, this point may not be directly reported to application software.

<sup>2</sup>A device's **grip pose** is the oriented point within its physical body where the user's palm holds the device. The grip pose's position is a point along the ray normal to the user's palm at its centroid, centered within the controller's grip. The grip pose's orientation has its forward axis pointed along the handle of the controller in the direction of the user's thumb. The grip pose's orientation has its right axis pointed along the ray normal to the user's palm when opened to form a flat 5-finger pose. (forward from the left palm and backward from the right palm)

<sup>3</sup>A device's **pointer pose** is the oriented point at its tip where users would expect a pointing ray to emerge. The pointer pose's orientation has its forward axis pointing along the device's natural pointing ray, with the up axis aligned to point straight up away from gravity when the controller is held in its neutral pointing orientation.

# 10 Keyboard/Keypad Page (0x07)

This section is the **Usage Page** for key codes to be used in implementing a USB keyboard. A Boot Keyboard (84-, 101- or 104-key) should at a minimum support all associated usage codes as indicated in the *Boot* column below.

The usage type of all key codes is Selectors (Sel), except for the modifier keys Keyboard Left Control (0x224) to Keyboard Right GUI (0x231) which are Dynamic Flags (DV).

*Note: A general note on Usages and languages: Due to the variation of keyboards from language to language, it is not feasible to specify exact key mappings for every language. Where this list is not specific for a key function in a language, the closest equivalent key position should be used, so that a keyboard may be modified for a different language by simply printing different keycaps. One example is the Y key on a North American keyboard. In Germany this is typically Z. Rather than changing the keyboard firmware to put the Z Usage into that place in the descriptor list, the vendor should use the Y Usage on both the North American and German keyboards. This continues to be the existing practice in the industry, in order to minimize the number of changes to the electronics to accommodate other languages.*

Usage ID	Usage Name	Usage Type	AT-101	PC-AT	Mac	Unix	Boot
00-00	<i>Reserved</i>						
01	Keyboard ErrorRollOver <sup>1</sup>	Sel	N/A	✓	✓	✓	4/101/104
02	Keyboard POSTFail <sup>1</sup>	Sel	N/A	✓	✓	✓	4/101/104
03	Keyboard ErrorUndefined <sup>1</sup>	Sel	N/A	✓	✓	✓	4/101/104
04	Keyboard a and A <sup>2</sup>	Sel	31	✓	✓	✓	4/101/104
05	Keyboard b and B	Sel	50	✓	✓	✓	4/101/104
06	Keyboard c and C <sup>2</sup>	Sel	48	✓	✓	✓	4/101/104
07	Keyboard d and D	Sel	33	✓	✓	✓	4/101/104
08	Keyboard e and E	Sel	19	✓	✓	✓	4/101/104
09	Keyboard f and F	Sel	34	✓	✓	✓	4/101/104
0A	Keyboard g and G	Sel	35	✓	✓	✓	4/101/104
0B	Keyboard h and H	Sel	36	✓	✓	✓	4/101/104
0C	Keyboard i and I	Sel	24	✓	✓	✓	4/101/104
0D	Keyboard j and J	Sel	37	✓	✓	✓	4/101/104
0E	Keyboard k and K	Sel	38	✓	✓	✓	4/101/104
0F	Keyboard l and L	Sel	39	✓	✓	✓	4/101/104
10	Keyboard m and M <sup>2</sup>	Sel	52	✓	✓	✓	4/101/104
11	Keyboard n and N	Sel	51	✓	✓	✓	4/101/104
12	Keyboard o and O <sup>2</sup>	Sel	25	✓	✓	✓	4/101/104
13	Keyboard p and P <sup>2</sup>	Sel	26	✓	✓	✓	4/101/104
14	Keyboard q and Q <sup>2</sup>	Sel	17	✓	✓	✓	4/101/104
15	Keyboard r and R	Sel	20	✓	✓	✓	4/101/104
16	Keyboard s and S	Sel	32	✓	✓	✓	4/101/104
17	Keyboard t and T	Sel	21	✓	✓	✓	4/101/104
18	Keyboard u and U	Sel	23	✓	✓	✓	4/101/104

Usage ID	Usage Name	Usage Type	AT-101	PC-AT	Mac	Unix	Boot
19	Keyboard v and V	Sel	49	✓	✓	✓	4/101/104
1A	Keyboard w and W <sup>2</sup>	Sel	18	✓	✓	✓	4/101/104
1B	Keyboard x and X <sup>2</sup>	Sel	47	✓	✓	✓	4/101/104
1C	Keyboard y and Y <sup>2</sup>	Sel	22	✓	✓	✓	4/101/104
1D	Keyboard z and Z <sup>2</sup>	Sel	46	✓	✓	✓	4/101/104
1E	Keyboard 1 and ! <sup>2</sup>	Sel	2	✓	✓	✓	4/101/104
1F	Keyboard 2 and @ <sup>2</sup>	Sel	3	✓	✓	✓	4/101/104
20	Keyboard 3 and # <sup>2</sup>	Sel	4	✓	✓	✓	4/101/104
21	Keyboard 4 and \$ <sup>2</sup>	Sel	5	✓	✓	✓	4/101/104
22	Keyboard 5 and % <sup>2</sup>	Sel	6	✓	✓	✓	4/101/104
23	Keyboard 6 and ^ <sup>2</sup>	Sel	7	✓	✓	✓	4/101/104
24	Keyboard 7 and & <sup>2</sup>	Sel	8	✓	✓	✓	4/101/104
25	Keyboard 8 and * <sup>2</sup>	Sel	9	✓	✓	✓	4/101/104
26	Keyboard 9 and ( <sup>2</sup>	Sel	10	✓	✓	✓	4/101/104
27	Keyboard 0 and ) <sup>2</sup>	Sel	11	✓	✓	✓	4/101/104
28	Keyboard Return (ENTER) <sup>3</sup>	Sel	43	✓	✓	✓	4/101/104
29	Keyboard ESCAPE	Sel	110	✓	✓	✓	4/101/104
2A	Keyboard DELETE (Backspace) <sup>4</sup>	Sel	15	✓	✓	✓	4/101/104
2B	Keyboard Tab	Sel	16	✓	✓	✓	4/101/104
2C	Keyboard Spacebar	Sel	61	✓	✓	✓	4/101/104
2D	Keyboard - and (underscore) <sup>2</sup>	Sel	12	✓	✓	✓	4/101/104
2E	Keyboard = and + <sup>2</sup>	Sel	13	✓	✓	✓	4/101/104
2F	Keyboard [ and { <sup>2</sup>	Sel	27	✓	✓	✓	4/101/104
30	Keyboard ] and } <sup>2</sup>	Sel	28	✓	✓	✓	4/101/104
31	Keyboard \ and	Sel	29	✓	✓	✓	4/101/104
32	Keyboard Non-US # and ~ <sup>5</sup>	Sel	42	✓	✓	✓	4/101/104
33	Keyboard ; and : <sup>2</sup>	Sel	40	✓	✓	✓	4/101/104
34	Keyboard ‘ and “ <sup>2</sup>	Sel	41	✓	✓	✓	4/101/104
35	Keyboard Grave Accent and Tilde <sup>2</sup>	Sel	1	✓	✓	✓	4/101/104
36	Keyboard , and < <sup>2</sup>	Sel	53	✓	✓	✓	4/101/104
37	Keyboard . and > <sup>2</sup>	Sel	54	✓	✓	✓	4/101/104
38	Keyboard / and ? <sup>2</sup>	Sel	55	✓	✓	✓	4/101/104
39	Keyboard Caps Lock <sup>6</sup>	Sel	30	✓	✓	✓	4/101/104
3A	Keyboard F1	Sel	112	✓	✓	✓	4/101/104
3B	Keyboard F2	Sel	113	✓	✓	✓	4/101/104
3C	Keyboard F3	Sel	114	✓	✓	✓	4/101/104
3D	Keyboard F4	Sel	115	✓	✓	✓	4/101/104

Usage ID	Usage Name	Usage Type	AT-101	PC-AT	Mac	Unix	Boot
3E	Keyboard F5	Sel	116	✓	✓	✓	4/101/104
3F	Keyboard F6	Sel	117	✓	✓	✓	4/101/104
40	Keyboard F7	Sel	118	✓	✓	✓	4/101/104
41	Keyboard F8	Sel	119	✓	✓	✓	4/101/104
42	Keyboard F9	Sel	120	✓	✓	✓	4/101/104
43	Keyboard F10	Sel	121	✓	✓	✓	4/101/104
44	Keyboard F11	Sel	122	✓	✓	✓	4/101/104
45	Keyboard F12	Sel	123	✓	✓	✓	4/101/104
46	Keyboard PrintScreen <sup>7</sup>	Sel	124	✓	✓	✓	4/101/104
47	Keyboard Scroll Lock <sup>6</sup>	Sel	125	✓	✓	✓	4/101/104
48	Keyboard Pause <sup>7</sup>	Sel	126	✓	✓	✓	4/101/104
49	Keyboard Insert <sup>7</sup>	Sel	75	✓	✓	✓	4/101/104
4A	Keyboard Home <sup>7</sup>	Sel	80	✓	✓	✓	4/101/104
4B	Keyboard PageUp <sup>7</sup>	Sel	85	✓	✓	✓	4/101/104
4C	Keyboard Delete Forward <sup>7,8</sup>	Sel	76	✓	✓	✓	4/101/104
4D	Keyboard End <sup>7</sup>	Sel	81	✓	✓	✓	4/101/104
4E	Keyboard PageDown <sup>7</sup>	Sel	86	✓	✓	✓	4/101/104
4F	Keyboard RightArrow <sup>7</sup>	Sel	89	✓	✓	✓	4/101/104
50	Keyboard LeftArrow <sup>7</sup>	Sel	79	✓	✓	✓	4/101/104
51	Keyboard DownArrow <sup>7</sup>	Sel	84	✓	✓	✓	4/101/104
52	Keyboard UpArrow <sup>7</sup>	Sel	83	✓	✓	✓	4/101/104
53	Keypad Num Lock and Clear <sup>6</sup>	Sel	90	✓	✓	✓	4/101/104
54	Keypad / <sup>7</sup>	Sel	95	✓	✓	✓	4/101/104
55	Keypad *	Sel	100	✓	✓	✓	4/101/104
56	Keypad -	Sel	105	✓	✓	✓	4/101/104
57	Keypad +	Sel	106	✓	✓	✓	4/101/104
58	Keypad ENTER <sup>3</sup>	Sel	108	✓	✓	✓	4/101/104
59	Keypad 1 and End	Sel	93	✓	✓	✓	4/101/104
5A	Keypad 2 and Down Arrow	Sel	98	✓	✓	✓	4/101/104
5B	Keypad 3 and PageDn	Sel	103	✓	✓	✓	4/101/104
5C	Keypad 4 and Left Arrow	Sel	92	✓	✓	✓	4/101/104
5D	Keypad 5	Sel	97	✓	✓	✓	4/101/104
5E	Keypad 6 and Right Arrow	Sel	102	✓	✓	✓	4/101/104
5F	Keypad 7 and Home	Sel	91	✓	✓	✓	4/101/104
60	Keypad 8 and Up Arrow	Sel	96	✓	✓	✓	4/101/104
61	Keypad 9 and PageUp	Sel	101	✓	✓	✓	4/101/104
62	Keypad 0 and Insert	Sel	99	✓	✓	✓	4/101/104

Usage ID	Usage Name	Usage Type	AT-101	PC-AT	Mac	Unix	Boot
63	Keypad . and Delete	Sel	104	✓	✓	✓	4/101/104
64	Keyboard Non-US \and   <sup>9,10</sup>	Sel	45	✓	✓	✓	4/101/104
65	Keyboard Application <sup>11</sup>	Sel	129	✓		✓	104
66	Keyboard Power <sup>1</sup>	Sel			✓	✓	
67	Keypad =	Sel			✓		
68	Keyboard F13	Sel			✓		
69	Keyboard F14	Sel			✓		
6A	Keyboard F15	Sel			✓		
6B	Keyboard F16	Sel					
6C	Keyboard F17	Sel					
6D	Keyboard F18	Sel					
6E	Keyboard F19	Sel					
6F	Keyboard F20	Sel					
70	Keyboard F21	Sel					
71	Keyboard F22	Sel					
72	Keyboard F23	Sel					
73	Keyboard F24	Sel					
74	Keyboard Execute	Sel				✓	
75	Keyboard Help	Sel				✓	
76	Keyboard Menu	Sel				✓	
77	Keyboard Select	Sel				✓	
78	Keyboard Stop	Sel				✓	
79	Keyboard Again	Sel				✓	
7A	Keyboard Undo	Sel				✓	
7B	Keyboard Cut	Sel				✓	
7C	Keyboard Copy	Sel				✓	
7D	Keyboard Paste	Sel				✓	
7E	Keyboard Find	Sel				✓	
7F	Keyboard Mute	Sel				✓	
80	Keyboard Volume Up	Sel				✓	
81	Keyboard Volume Down	Sel				✓	
82	Keyboard Locking Caps Lock <sup>12</sup>	Sel				✓	
83	Keyboard Locking Num Lock <sup>12</sup>	Sel				✓	
84	Keyboard Locking Scroll Lock <sup>12</sup>	Sel				✓	
85	Keypad Comma <sup>13</sup>	Sel	107				
86	Keypad Equal Sign <sup>14</sup>	Sel				✓	
87	Keyboard International1 <sup>15,16</sup>	Sel	56				
88	Keyboard International2 <sup>17</sup>	Sel					
89	Keyboard International3 <sup>18</sup>	Sel					
8A	Keyboard International4 <sup>19</sup>	Sel					

Usage ID	Usage Name	Usage Type	AT-101	PC-AT	Mac	Unix	Boot
8B	Keyboard International <sup>5</sup> <sup>20</sup>	Sel					
8C	Keyboard International <sup>6</sup> <sup>21</sup>	Sel					
8D	Keyboard International <sup>7</sup> <sup>22</sup>	Sel					
8E	Keyboard International <sup>8</sup> <sup>23</sup>	Sel					
8F	Keyboard International <sup>9</sup> <sup>23</sup>	Sel					
90	Keyboard LANG <sup>1</sup> <sup>24</sup>	Sel					
91	Keyboard LANG <sup>2</sup> <sup>25</sup>	Sel					
92	Keyboard LANG <sup>3</sup> <sup>26</sup>	Sel					
93	Keyboard LANG <sup>4</sup> <sup>27</sup>	Sel					
94	Keyboard LANG <sup>5</sup> <sup>28</sup>	Sel					
95	Keyboard LANG <sup>6</sup> <sup>29</sup>	Sel					
96	Keyboard LANG <sup>7</sup> <sup>29</sup>	Sel					
97	Keyboard LANG <sup>8</sup> <sup>29</sup>	Sel					
98	Keyboard LANG <sup>9</sup> <sup>29</sup>	Sel					
99	Keyboard Alternate Erase <sup>30</sup>	Sel					
9A	Keyboard SysReq/Attention <sup>7</sup>	Sel					
9B	Keyboard Cancel	Sel					
9C	Keyboard Clear	Sel					
9D	Keyboard Prior	Sel					
9E	Keyboard Return	Sel					
9F	Keyboard Separator	Sel					
A0	Keyboard Out	Sel					
A1	Keyboard Oper	Sel					
A2	Keyboard Clear/Again	Sel					
A3	Keyboard CrSel/Props	Sel					
A4	Keyboard ExSel	Sel					
A5-AF	<i>Reserved</i>						
B0	Keypad 00	Sel					
B1	Keypad 000	Sel					
B2	Thousands Separator <sup>31</sup>	Sel					
B3	Decimal Separator <sup>31</sup>	Sel					
B4	Currency Unit <sup>32</sup>	Sel					
B5	Currency Sub-unit <sup>32</sup>	Sel					
B6	Keypad (	Sel					
B7	Keypad )	Sel					
B8	Keypad {	Sel					
B9	Keypad }	Sel					
BA	Keypad Tab	Sel					
BB	Keypad Backspace	Sel					

Usage ID	Usage Name	Usage Type	AT-101	PC-AT	Mac	Unix	Boot
BC	Keypad A	Sel					
BD	Keypad B	Sel					
BE	Keypad C	Sel					
BF	Keypad D	Sel					
C0	Keypad E	Sel					
C1	Keypad F	Sel					
C2	Keypad XOR	Sel					
C3	Keypad ^	Sel					
C4	Keypad %	Sel					
C5	Keypad <	Sel					
C6	Keypad >	Sel					
C7	Keypad &	Sel					
C8	Keypad &&	Sel					
C9	Keypad	Sel					
CA	Keypad	Sel					
CB	Keypad :	Sel					
CC	Keypad #	Sel					
CD	Keypad Space	Sel					
CE	Keypad @	Sel					
CF	Keypad !	Sel					
D0	Keypad Memory Store	Sel					
D1	Keypad Memory Recall	Sel					
D2	Keypad Memory Clear	Sel					
D3	Keypad Memory Add	Sel					
D4	Keypad Memory Subtract	Sel					
D5	Keypad Memory Multiply	Sel					
D6	Keypad Memory Divide	Sel					
D7	Keypad +/-	Sel					
D8	Keypad Clear	Sel					
D9	Keypad Clear Entry	Sel					
DA	Keypad Binary	Sel					
DB	Keypad Octal	Sel					
DC	Keypad Decimal	Sel					
DD	Keypad Hexadecimal	Sel					
DE-DF	<i>Reserved</i>						
E0	Keyboard LeftControl	DV	58	✓	✓	✓	4/101/104
E1	Keyboard LeftShift	DV	44	✓	✓	✓	4/101/104
E2	Keyboard LeftAlt	DV	60	✓	✓	✓	4/101/104
E3	Keyboard Left GUI <sup>11,33</sup>	DV	127	✓	✓	✓	104
E4	Keyboard RightControl	DV	64	✓	✓	✓	101/104



Usage ID	Usage Name	Usage Type	AT-101	PC-AT	Mac	Unix	Boot
E5	Keyboard RightShift	DV	57	✓	✓	✓	4/101/104
E6	Keyboard RightAlt	DV	62	✓	✓	✓	101/104
E7	Keyboard Right GUI <sup>11,34</sup>	DV	128	✓	✓	✓	104
E8-FFFF	<i>Reserved</i>						

<sup>1</sup>Reserved for typical keyboard status or keyboard errors. Sent as a member of the keyboard array. Not a physical key.

<sup>2</sup>Typically remapped for other languages in the host system.

<sup>3</sup>Keyboard Enter and Keypad Enter generate different Usage codes.

<sup>4</sup>Backs up the cursor one position, deleting a character as it goes.

<sup>5</sup>Typical language mappings: US: \|Belg: μ `£French Canadian: <>Danish: '\* Dutch: <>French: \*μ German: # 'Italian: ù §LatinAmerica: } `| Norwegian: , \* Spain: }Ç Swedish: , \* Swiss: \$ £UK: # ~

<sup>6</sup>Implemented as a non-locking key; sent as member of an array.

<sup>7</sup>Usage of keys is not modified by the state of the Control, Alt, Shift or Num Lock keys. That is, a key does not send extra codes to compensate for the state of any Control, Alt, Shift or Num Lock keys.

<sup>8</sup>Deletes one character without changing position.

<sup>9</sup>Typical language mappings: Belg: <\>French Canadian: <°>Danish: <|>Dutch: ||| French: <>German: <|>Italian: <>LatinAmerica: <>Norwegian: <>Spain: <>Swedish: <|>Swiss: <>UK: \|Brazil: \|

<sup>10</sup>Typically near the Left-Shift key in AT-102 implementations.

<sup>11</sup>Windows key for Windows 95, and *Compose*.

<sup>12</sup>Implemented as a locking key; sent as a toggle button. Available for legacy support; however, most systems should use the non-locking version of this key.

<sup>13</sup>Keypad Comma is the appropriate usage for the Brazilian keypad period (.) key. This represents the closest possible match, and system software should do the correct mapping based on the current locale setting.

<sup>14</sup>Used on AS/400 keyboards.

<sup>15</sup>See additional footnotes below

<sup>16</sup>Keyboard International1 should be identified via footnote as the appropriate usage for the Brazilian forward-slash (/) and question-mark (?) key. This usage should also be renamed to either "Keyboard Non-US / and ?" or to "Keyboard International1" now that it's become clear that it does not only apply to Kanji keyboards anymore.

<sup>17</sup>See additional footnotes below

<sup>18</sup>See additional footnotes below

<sup>19</sup>See additional footnotes below

<sup>20</sup>See additional footnotes below

<sup>21</sup>See additional footnotes below

<sup>22</sup>Toggle Double-Byte/Single-Byte mode.

<sup>23</sup>Undefined, available for other Front End Language Processors.

<sup>24</sup>Hangul/English toggle key. This usage is used as an input method editor control key on a Korean language keyboard.

<sup>25</sup>Hanja conversion key. This usage is used as an input method editor control key on a Korean language keyboard.

<sup>26</sup>Defines the Katakana key for Japanese USB word-processing keyboards.

<sup>27</sup>Defines the Hiragana key for Japanese USB word-processing keyboards.

<sup>28</sup>Defines the Zenkaku/Hankaku key for Japanese USB word-processing keyboards.

<sup>29</sup>Reserved for language-specific functions, such as Front End Processors and Input Method Editors.

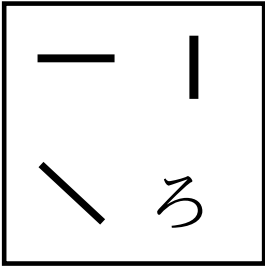
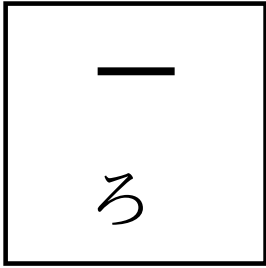

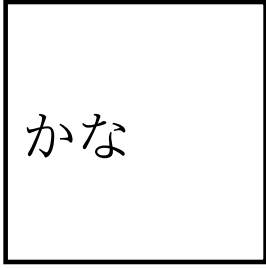
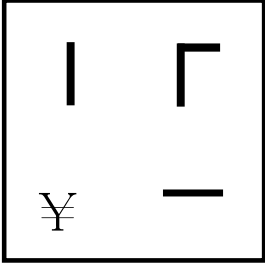
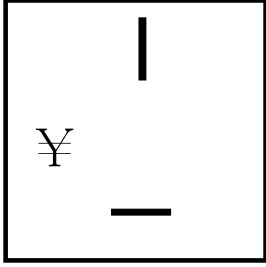

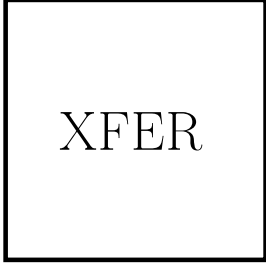

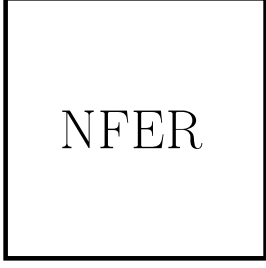
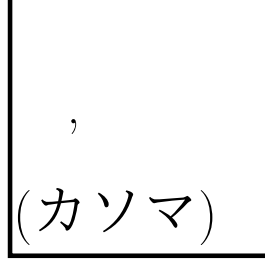
<sup>30</sup>Example, Erase-Eaze™ key.

<sup>31</sup>The symbol displayed will depend on the current locale settings of the operating system. For example, the US thousands separator would be a comma, and the decimal separator would be a period.

<sup>32</sup>The symbol displayed will depend on the current locale settings of the operating system. For example the US currency unit would be \$ and the sub-unit would be c.

<sup>33</sup>Windowing environment key, examples are Microsoft Left Win key, Mac Left Apple key, Sun Left Meta key

<sup>34</sup>Windowing environment key, examples are Microsoft®RIGHT WIN key, Macintosh®RIGHT APPLE key, Sun®RIGHT META key.

Note	AT-104	DOS/V-109 (suggested)	PC98 (suggested)
15	No Function		
17	No Function		
18	No Function		
19	No Function		
20	No Function		
21	No Function	No Function	

# 11 LED Page (0x08)

An LED or indicator is implemented as an On/Off Control (OOC) using the *Single button toggle* mode, where a value of 1 will turn on the indicator, and a value of 0 will turn it off. The exceptions are described below.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	Num Lock	OOC	<a href="#">11.1</a>
02	Caps Lock	OOC	<a href="#">11.1</a>
03	Scroll Lock	OOC	<a href="#">11.1</a>
04	Compose	OOC	<a href="#">11.1</a>
05	Kana	OOC	<a href="#">11.1</a>
06	Power	OOC	<a href="#">11.6</a>
07	Shift	OOC	<a href="#">11.1</a>
08	Do Not Disturb	OOC	<a href="#">11.2</a>
09	Mute	OOC	<a href="#">11.3</a>
0A	Tone Enable	OOC	<a href="#">11.3</a>
0B	High Cut Filter	OOC	<a href="#">11.3</a>
0C	Low Cut Filter	OOC	<a href="#">11.3</a>
0D	Equalizer Enable	OOC	<a href="#">11.3</a>
0E	Sound Field On	OOC	<a href="#">11.3</a>
0F	Surround On	OOC	<a href="#">11.3</a>
10	Repeat	OOC	<a href="#">11.3</a>
11	Stereo	OOC	<a href="#">11.3</a>
12	Sampling Rate Detect	OOC	<a href="#">11.3</a>
13	Spinning	OOC	<a href="#">11.4</a>
14	CAV	OOC	<a href="#">11.3</a>
15	CLV	OOC	<a href="#">11.3</a>
16	Recording Format Detect	OOC	<a href="#">11.4</a>
17	Off-Hook	OOC	<a href="#">11.2</a>
18	Ring	OOC	<a href="#">11.2</a>
19	Message Waiting	OOC	<a href="#">11.2</a>
1A	Data Mode	OOC	<a href="#">11.2</a>
1B	Battery Operation	OOC	<a href="#">11.6</a>
1C	Battery OK	OOC	<a href="#">11.6</a>
1D	Battery Low	OOC	<a href="#">11.6</a>
1E	Speaker	OOC	<a href="#">11.2</a>
1F	Head Set	OOC	<a href="#">11.2</a>
20	Hold	OOC	<a href="#">11.2</a>
21	Microphone	OOC	<a href="#">11.2</a>
22	Coverage	OOC	<a href="#">11.2</a>
23	Night Mode	OOC	<a href="#">11.2</a>
24	Send Calls	OOC	<a href="#">11.2</a>
25	Call Pickup	OOC	<a href="#">11.2</a>

26	Conference	OOC	<a href="#">11.2</a>
27	Stand-by	OOC	<a href="#">11.6</a>
28	Camera On	OOC	<a href="#">11.3</a>
29	Camera Off	OOC	<a href="#">11.3</a>
2A	On-Line	OOC	<a href="#">11.6</a>
2B	Off-Line	OOC	<a href="#">11.6</a>
2C	Busy	OOC	<a href="#">11.6</a>
2D	Ready	OOC	<a href="#">11.6</a>
2E	Paper-Out	OOC	<a href="#">11.5</a>
2F	Paper-Jam	OOC	<a href="#">11.5</a>
30	Remote	OOC	<a href="#">11.6</a>
31	Forward	OOC	<a href="#">11.4</a>
32	Reverse	OOC	<a href="#">11.4</a>
33	Stop	OOC	<a href="#">11.4</a>
34	Rewind	OOC	<a href="#">11.4</a>
35	Fast Forward	OOC	<a href="#">11.4</a>
36	Play	OOC	<a href="#">11.4</a>
37	Pause	OOC	<a href="#">11.4</a>
38	Record	OOC	<a href="#">11.4</a>
39	Error	OOC	<a href="#">11.6</a>
3A	<b>Usage Selected Indicator</b>	US	<a href="#">11.6</a>
3B	<b>Usage In Use Indicator</b>	US	<a href="#">11.6</a>
3C	<b>Usage Multi Mode Indicator</b>	UM	<a href="#">11.6</a>
3D	Indicator On	Sel	<a href="#">11.6</a>
3E	Indicator Flash	Sel	<a href="#">11.6</a>
3F	Indicator Slow Blink	Sel	<a href="#">11.6</a>
40	Indicator Fast Blink	Sel	<a href="#">11.6</a>
41	Indicator Off	Sel	<a href="#">11.6</a>
42	Flash On Time	DV	<a href="#">11.6</a>
43	Slow Blink On Time	DV	<a href="#">11.6</a>
44	Slow Blink Off Time	DV	<a href="#">11.6</a>
45	Fast Blink On Time	DV	<a href="#">11.6</a>
46	Fast Blink Off Time	DV	<a href="#">11.6</a>
47	<b>Usage Indicator Color</b>	UM	<a href="#">11.6</a>
48	Indicator Red	Sel	<a href="#">11.6</a>
49	Indicator Green	Sel	<a href="#">11.6</a>
4A	Indicator Amber	Sel	<a href="#">11.6</a>
4B	Generic Indicator	OOC	<a href="#">11.6</a>
4C	System Suspend	OOC	<a href="#">11.6</a>
4D	External Power Connected	OOC	<a href="#">11.6</a>
4E	Indicator Blue <a href="#">[6]</a>	Sel	<a href="#">11.6</a>
4F	Indicator Orange <a href="#">[6]</a>	Sel	<a href="#">11.6</a>
50	Good Status <a href="#">[6]</a>	OOC	<a href="#">11.6</a>
51	Warning Status <a href="#">[6]</a>	OOC	<a href="#">11.6</a>

52	RGB LED [6]	CL	<a href="#">11.7</a>
53	Red LED Channel [6]	DV	<a href="#">11.7</a>
54	Blue LED Channel [6]	DV	<a href="#">11.7</a>
55	Green LED Channel [6]	DV	<a href="#">11.7</a>
56	LED Intensity [6]	DV	<a href="#">11.7</a>
57-5F	<i>Reserved</i>		
60	<b>Player Indicator</b> [29]	NAry	<a href="#">11.8</a>
61	Player 1 [29]	Sel	<a href="#">11.8</a>
62	Player 2 [29]	Sel	<a href="#">11.8</a>
63	Player 3 [29]	Sel	<a href="#">11.8</a>
64	Player 4 [29]	Sel	<a href="#">11.8</a>
65	Player 5 [29]	Sel	<a href="#">11.8</a>
66	Player 6 [29]	Sel	<a href="#">11.8</a>
67	Player 7 [29]	Sel	<a href="#">11.8</a>
68	Player 8 [29]	Sel	<a href="#">11.8</a>
69-FFFF	<i>Reserved</i>		

Table 11.1: LED Page

*Note: The Usage Selected Indicator, Usage In Use Indicator, and Usage Multi Mode Indicator usages can change the usage type of the usage(s) that they contain.*

## 11.1 Keyboard Indicators

Usage Name	Usage Type	Description
Num Lock	OOC	Indicates that Number Lock is enabled.
Caps Lock	OOC	Indicates that Capital Lock is enabled.
Scroll Lock	OOC	Indicates that Scroll Lock is enabled.
Compose	OOC	Indicates that composition mode is enabled.
Kana	OOC	Indicates that Kana mode is enabled.
Shift	OOC	Indicates that the Shift function is enabled.

## 11.2 Telephony Indicators

Usage Name	Usage Type	Description
Do Not Disturb	OOC	(Phone) Indicates that the phone is not accepting incoming calls.
Off-Hook	OOC	(Phone) Indicates that the handset is off-hook.
Ring	OOC	(Phone) Indicates visually that a phone is ringing.
Message Waiting	OOC	(Phone, answering machine) Indicates that a message has been recorded and has not yet been heard.
Data Mode	OOC	(Phone) Indicates that the phone is in a mode that transfers data (rather than voice).
Speaker	OOC	(Phone) Indicates that the phone is using the speaker/microphone instead of a handset or headset.
Head Set	OOC	(Phone) Indicates that the phone is using the headset instead of a handset or speaker/microphone.
Hold	OOC	(Phone) Indicates that the caller is on hold.
Microphone	OOC	(Phone) Indicates that the microphone has been muted.
Coverage	OOC	(Phone) Indicates that incoming calls are forwarded to a covering station.
Night Mode	OOC	(Phone) Indicates that the phone is in after-hours mode.
Send Calls	OOC	(Phone) Indicates that incoming calls are forwarded to another station.
Call Pickup	OOC	(Phone) Indicates that a call in the user's pickup group has been accepted. Pickup groups associate phones in an area. They allow a ringing phone to be picked up by any other phone in the group.
Conference	OOC	(Phone) Indicates that the phone is in conference call mode.

## 11.3 Consumer Indicators

Usage Name	Usage Type	Description
Mute	OOC	Indicates that amplifier audio output is shut off.
Tone Enable	OOC	Indicates that tone controls are functional.
High Cut Filter	OOC	Indicates that the high cut filter is enabled.
Low Cut Filter	OOC	Indicates that the low cut filter is enabled.
Equalizer Enable	OOC	Indicates that tone shape processing is active.
Sound Field On	OOC	Indicates that DSP processing is active.
Surround On	OOC	Indicates that surround channel information is being decoded.
Repeat	OOC	Indicates that the playback device is in repeat mode.
Stereo	OOC	Indicates that the signal currently being received by the tuner is in stereo.
Sampling Rate Detect	OOC	Indicates that a digital audio signal has been detected.
CAV	OOC	Indicates that the video disc media is in Constant Angular Velocity format.
CLV	OOC	Indicates that the video disc media is in Constant Linear Velocity format.
Camera On	OOC	Indicates that the camera is recording images.
Camera Off	OOC	Indicates that the camera is powered but not recording images.



## 11.4 Media Transport Indicators

Usage Name	Usage Type	Description
Spinning	OOC	Indicates that disc media is up to the speed required for playback/read.
Recording Format Detect	OOC	Indicates that a valid recording format has been detected.
Stop	OOC	Indicates that a device's media transport mechanism has been disengaged.
Forward	OOC	Indicates that a device's media transport mechanism or a device is in forward mode.
Reverse	OOC	Indicates that a device's media transport mechanism or a device is in reverse mode.
Rewind	OOC	Indicates that a device's media transport mechanism is in rewind mode.
Fast Forward	OOC	Indicates that a device's media transport mechanism is in fast forward mode.
Play	OOC	Indicates that a device's media transport mechanism is in playback mode. This indicator may also be true when a device is recording.
Pause	OOC	Indicates that a device's media transport mechanism has been paused while playing back or recording.

## 11.5 Printer Indicators

Usage Name	Usage Type	Description
Paper-Out	OOC	Indicates that the device is out of paper.
Paper-Jam	OOC	Indicates that a paper jam has occurred in the device and operator intervention is required.

## 11.6 General Device Indicators

Usage Name	Usage Type	Description
Power	OOC	Indicates that the device is powered.
Stand-by	OOC	Indicates that the device is in standby mode.
On-Line	OOC	Indicates that the device is online.
Off-Line	OOC	Indicates that the device is offline.
Busy	OOC	Indicates that the device is busy executing operations.
Ready	OOC	Indicates that the device is ready to execute operations.
Remote	OOC	Indicates that the device is being controlled remotely.
Error	OOC	Indicates that an error has occurred on the device.
Battery Operation	OOC	Indicates that the device is currently battery powered.
Battery OK	OOC	Indicates that the battery is in a nominal charge state.
Battery Low	OOC	Indicates that the battery is in a low charge state.
<b>Usage Selected Indicator</b>	US	This collection allows the usages that it contains to be associated with a visual output (an LED) that indicates whether a control identified by the usage is selected. <b>Usage Selected Indicator</b> is a 1-bit field where 1 is selected and 0 is not selected. All usages found in this collection will be treated as On/Off Controls (OOC).
<b>Usage In Use Indicator</b>	US	This collection allows the usages that it contains to be associated with a visual output (an LED) that indicates whether a control identified by the usage is in use. <b>Usage In Use Indicator</b> is a 1-bit field where 1 is in use and 0 is not in use. All usages found in this collection will be treated as On/Off Controls (OOC).
<b>Usage Multi Mode Indicator<sup>1</sup></b>	UM	This usage names a logical collection which must be contained in another collection. The usage attached to the encompassing collection is then identified as an indicator that supports multiple illumination modes. In this collection one or more of the following Indicator selectors will be found: On, Flash, Slow Blink, Fast Blink, and Off.
Indicator On	Sel	Light indicator continuously.
Indicator Flash	Sel	Single, momentary illumination of indicator.
Indicator Slow Blink	Sel	Continuous flashing of the indicator at a slow rate.
Indicator Fast Blink	Sel	Continuous flashing of the indicator at a fast rate.
Indicator Off	Sel	Turn indicator illumination off.
Flash On Time	DV	Duration that the indicator is illuminated in flash mode.
Slow Blink On Time	DV	Duration that the indicator is illuminated in slow blink mode.
Slow Blink Off Time	DV	Duration that the indicator is off in slow blink mode.
Fast Blink On Time	DV	Duration that the indicator is illuminated in fast blink mode.
Fast Blink Off Time	DV	Duration that the indicator is off in fast blink mode.
<b>Usage Indicator Color<sup>1</sup></b>	UM	This collection allows the usage that contains it to be an indicator that supports multiple colors. All usages found in this collection will be treated as a Selectors (Sel) where one or more of the following Indicator selectors will be found: Indicator Off, Red, Green, and Amber.
Indicator Red	Sel	Indicator color set to Red.
Indicator Green	Sel	Indicator color set to Green.
Indicator Amber	Sel	Indicator color set to Amber. This is typically implemented by asserting Red and Green simultaneously.

Generic Indicator	OOC	This usage identifies an indicator that has no permanently assigned function.
System Suspend	OOC	Indicates that the system is in a low power state, but is still powered and retaining some context.
External Power Connected	OOC	Indicates that a battery-operated system is connected to external power.
Indicator Blue	Sel	Indicator color set to Blue.
Indicator Orange	Sel	Indicator color set to Orange.
Good Status	OOC	Indicates that the device is operating within normal parameters.
Warning Status	OOC	Indicates that the device is not operating within normal parameters, but that the situation has not reached the level of an error (see Error).

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<sup>1</sup>An indicator can support Multi Mode features and multiple colors simultaneously. To tie these functions together, they can be wrapped in a logical collection where the usage that is attached to the collection defines the purpose of the control.

## 11.7 Multicolor (RGB) LED

Usage Name	Usage Type	Description
<b>RGB LED</b>	CL	A collection of controls for a color mixing (i.e., RGB) LED. An RGB LED shall contain a red, green, and blue channel usage and may include an intensity usage.
Red LED Channel	DV	Control setting the intensity of the red channel of a color-mixed LED.
Blue LED Channel	DV	Control setting the intensity of the blue channel of a color-mixed LED.
Green LED Channel	DV	Control setting the intensity of the green channel of a color-mixed LED.
LED Intensity	DV	Control setting the overall intensity of a color-mixed LED. This control should be represented as a percentage control using a logical minimum of zero and a logical maximum of 100.

## 11.8 Game Player Indicators

Game Player Indicators allow game controllers to have LEDs embedded that indicate which player the controller is assigned to. These LED usage definitions enable a more compatible and standardized game controller ecosystem.

Usage Name	Usage Type	Description
<b>Player Indicator</b>	Nary	A collection usage for assigning a player to a game controller. Two or more Player Selectors shall be included in the Named Array.
Player 1	Sel	Indicates that the game controller is assigned to player 1.
Player 2	Sel	Indicates that the game controller is assigned to player 2.
Player 3	Sel	Indicates that the game controller is assigned to player 3.
Player 4	Sel	Indicates that the game controller is assigned to player 4.
Player 5	Sel	Indicates that the game controller is assigned to player 5.
Player 6	Sel	Indicates that the game controller is assigned to player 6.
Player 7	Sel	Indicates that the game controller is assigned to player 7.
Player 8	Sel	Indicates that the game controller is assigned to player 8.

## 12 Button Page (0x09)

The Button page is the first place an application should look for user selection controls. System graphical user interfaces typically employ a pointer and a set of hierarchical selectors to select, move and otherwise manipulate their environment. For these purposes the following assignment of significance can be applied to the Button usages:

- Button 1, Primary Button. Used for object selecting, dragging, and double click activation. On MacOS, this is the only button. Microsoft operating systems call this a logical left button, because it is not necessarily physically located on the left of the pointing device.
- Button 2, Secondary Button. Used by newer graphical user interfaces to browse object properties. Exposed by systems to applications that typically assign application-specific functionality.
- Button 3, Tertiary Button. Optional control. Exposed to applications, but seldom assigned functionality due to prevalence of two and one button devices.
- Buttons 4 – 255. As the button number increases, its significance as a selector decreases.

In many ways the assignment of button numbers is similar to the assignment of **Effort** in **Physical** descriptors. Button 1 would be used to define the button a finger rests on when the hand is in the *at rest* position, that is, virtually no effort is required by the user to activate the button. Button values increment as the finger has to stretch to reach a control. See Section 6.2.3, *Physical Descriptors* in the HID Specification for methods of further qualifying buttons.

Usage ID	Usage Name	Usage Type
00	No Button Pressed	See Note
01	Button 1 (primary/trigger)	See Note
02	Button 2 (secondary)	See Note
03	Button 3 (tertiary)	See Note
04	Button 4	See Note
...	...	
FFFF	Button 65535	See Note

Table 12.1: Button Page

*Note: Buttons can be defined as Selectors (Sel), On/Off Controls (OOC), Momentary Controls (MC) or One-Shot Controls (OSC) depending on the context of their declaration.*

When defining buttons as selectors, Usage ID 0 is defined to indicate that no buttons are pressed. When declaring an array of buttons one can:

- Declare all buttons of interest, include the usage No Button Pressed, set the No NULL Position flag, and declare a **Logical Minimum** of 0.
- Only declare the buttons of interest, set the NULL State flag, and declare a **Logical Minimum** of 1. In this case the 0 value is out of range or NULL, and is interpreted as No Buttons Pressed.

In either case, by convention, a device that returns a value of 0 for an Array should be indicating that no button is pressed. Radio buttons are an exception to this rule because one button is always valid.

# 13 Ordinal Page (0x0A)

The Ordinal page allows multiple instances of a control or sets of controls to be declared without requiring individual enumeration in the native usage page. For example, it is not necessary to declare usages of Pointer 1, Pointer 2, and so forth on Section 4 [Generic Desktop Page \(0x01\)](#) . When parsed, the ordinal instance number is, in essence, concatenated to the usages attached to the encompassing collection to create Pointer 1, Pointer 2, and so forth.

By convention, an Ordinal collection is placed inside the collection for which it is declaring multiple instances.

Instances do not have to be identical.

Usage ID	Usage Name	Usage Type
00	<i>Reserved</i>	
01	Instance 1	UM
02	Instance 2	UM
03	Instance 3	UM
04	Instance 4	UM
...	...	
FFFF	Instance 65535	UM

Table 13.1: Ordinal Page



# 14 Telephony Device Page (0x0B)

This usage page defines the keytop and control usages for telephony devices. Note that in many cases usage definitions are intentionally vague, this is because it is assumed that the controls are interpreted by the telephone software application (PBX). For instance, one software implementation may allow the Park usage to hold the line open while waiting for the target number to go on-hook, while another implementation will allow the user to hang up and then ring the user back when the target number is available. Often recommendations are made so that users of USB telephones see consistent interfaces across multiple vendors, minimizing learning curves and frustration when dealing with new or multiple systems.

Indicators on a phone are handled by wrapping them in LED: **Usage In Use Indicator** and LED: **Usage Selected Indicator** usages. For example, a message-indicator LED would be identified by a Telephony: Message usage declared as a **Feature** or **Output** in a LED: **Usage In Use Indicator** collection.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Phone</b>	CA	<a href="#">14.1</a>
02	<b>Answering Machine</b>	CA	<a href="#">14.1</a>
03	<b>Message Controls</b>	CL	<a href="#">14.1</a>
04	<b>Handset</b>	CL	<a href="#">14.1</a>
05	<b>Headset</b>	CL	<a href="#">14.1</a>
06	<b>Telephony Key Pad</b>	NAry	<a href="#">14.2</a>
07	<b>Programmable Button</b>	NAry	<a href="#">14.2</a>
08-1F	<i>Reserved</i>		
20	Hook Switch	OOC	<a href="#">14.3</a>
21	Flash	MC	<a href="#">14.3</a>
22	Feature	OSC	<a href="#">14.3</a>
23	Hold	OOC	<a href="#">14.3</a>
24	Redial	OSC	<a href="#">14.3</a>
25	Transfer	OSC	<a href="#">14.3</a>
26	Drop	OSC	<a href="#">14.3</a>
27	Park	OOC	<a href="#">14.3</a>
28	Forward Calls	OOC	<a href="#">14.3</a>
29	Alternate Function	MC	<a href="#">14.3</a>
2A	<b>Line</b>	OSC/NAry	<a href="#">14.3</a>
2B	Speaker Phone	OOC	<a href="#">14.3</a>
2C	Conference	OOC	<a href="#">14.3</a>
2D	Ring Enable	OOC	<a href="#">14.3</a>
2E	Ring Select	OSC	<a href="#">14.3</a>
2F	Phone Mute	OOC	<a href="#">14.3</a>
30	Caller ID	MC	<a href="#">14.3</a>
31	Send	OOC	<a href="#">14.3</a>
32-4F	<i>Reserved</i>		
50	Speed Dial	OSC	<a href="#">14.4</a>
51	Store Number	OSC	<a href="#">14.4</a>
52	Recall Number	OSC	<a href="#">14.4</a>
53	Phone Directory	OOC	<a href="#">14.4</a>
54-6F	<i>Reserved</i>		

70	Voice Mail	OOC	14.5
71	Screen Calls	OOC	14.5
72	Do Not Disturb	OOC	14.5
73	Message	OSC	14.5
74	Answer On/Off	OOC	14.5
75-8F	<i>Reserved</i>		
90	Inside Dial Tone	MC	14.6
91	Outside Dial Tone	MC	14.6
92	Inside Ring Tone	MC	14.6
93	Outside Ring Tone	MC	14.6
94	Priority Ring Tone	MC	14.6
95	Inside Ringback	MC	14.6
96	Priority Ringback	MC	14.6
97	Line Busy Tone	MC	14.6
98	Reorder Tone	MC	14.6
99	Call Waiting Tone	MC	14.6
9A	Confirmation Tone 1	MC	14.6
9B	Confirmation Tone 2	MC	14.6
9C	Tones Off	OOC	14.6
9D	Outside Ringback	MC	14.6
9E	Ringer	OOC	14.6
9F-AF	<i>Reserved</i>		
B0	Phone Key 0	Sel	14.2
B1	Phone Key 1	Sel	14.2
B2	Phone Key 2	Sel	14.2
B3	Phone Key 3	Sel	14.2
B4	Phone Key 4	Sel	14.2
B5	Phone Key 5	Sel	14.2
B6	Phone Key 6	Sel	14.2
B7	Phone Key 7	Sel	14.2
B8	Phone Key 8	Sel	14.2
B9	Phone Key 9	Sel	14.2
BA	Phone Key Star	Sel	14.2
BB	Phone Key Pound	Sel	14.2
BC	Phone Key A	Sel	14.2
BD	Phone Key B	Sel	14.2
BE	Phone Key C	Sel	14.2
BF	Phone Key D	Sel	14.2
C0	Phone Call History Key [5]	Sel	14.7
C1	Phone Caller ID Key [5]	Sel	14.7
C2	Phone Settings Key [5]	Sel	14.7
C3-EF	<i>Reserved</i>		

F0	Host Control [5]	OOC	14.8
F1	Host Available [5]	OOC	14.8
F2	Host Call Active [5]	OOC	14.8
F3	Activate Handset Audio [5]	OOC	14.8
F4	<b>Ring Type</b> [5]	NArY	14.9
F5	Re-dialable Phone Number [5]	OOC	14.9
F6-F7	<i>Reserved</i>		
F8	Stop Ring Tone [5]	Sel	14.9
F9	PSTN Ring Tone [5]	Sel	14.9
FA	Host Ring Tone [5]	Sel	14.9
FB	Alert Sound Error [5]	Sel	14.9
FC	Alert Sound Confirm [5]	Sel	14.9
FD	Alert Sound Notification [5]	Sel	14.9
FE	Silent Ring [5]	Sel	14.9
FF-107	<i>Reserved</i>		
108	Email Message Waiting [5]	OOC	14.8
109	Voicemail Message Waiting [5]	OOC	14.8
10A	Host Hold [5]	OOC	14.8
10B-10F	<i>Reserved</i>		
110	Incoming Call History Count [5]	DV	14.10
111	Outgoing Call History Count [5]	DV	14.10
112	<b>Incoming Call History</b> [5]	CL	14.10
113	<b>Outgoing Call History</b> [5]	CL	14.10
114	Phone Locale [5]	DV	14.8
115-13F	<i>Reserved</i>		
140	Phone Time Second [5]	DV	14.9
141	Phone Time Minute [5]	DV	14.9
142	Phone Time Hour [5]	DV	14.9
143	Phone Date Day [5]	DV	14.9
144	Phone Date Month [5]	DV	14.9
145	Phone Date Year [5]	DV	14.9
146	Handset Nickname [5]	DV	14.9
147	Address Book ID [5]	DV	14.9
148-149	<i>Reserved</i>		
14A	Call Duration [5]	DV	14.10
14B	<b>Dual Mode Phone</b>	CA	14.8
14C-FFFF	<i>Reserved</i>		

Table 14.1: Telephony Device Page

## 14.1 Telephony Devices

Usage Name	Usage Type	Description
<b>Phone</b>	CA	An application-level collection that identifies a device containing telephone controls.
<b>Answering Machine</b>	CA	An application level collection that identifies a device containing primarily voice mail or answering machine controls.
<b>Dual Mode Phone</b>	CA	Top level collection of reports for a telephony device which can handle both standard PSTN phone and host based voice calls.
<b>Message Controls</b>	CL	Usages related to voice mail controls.
<b>Handset</b>	CL	Usages related to the handle-shaped part of a telephone, containing the audio receiver and transmitter.
<b>Headset</b>	CL	Usages related to the telephone headset (headphones and microphone), containing the audio receiver and transmitter.

## 14.2 Telephony Key Pad Usages

Usage Name	Usage Type	Description
<b>Telephony Key Pad</b>	NArY	<p>A collection usage for a standard telephony key pad (dial buttons 1 to 9, *, 0, and #). A Telephony Key Pad implies that the keytops are marked with a digit and associated alphabetic characters. This collection can also be used as a general-purpose 1 to 9 and 0 keypad. The Telephony Keypad collection contains the Phone Keypad selector usages.</p> <p>The phone keypad is defined distinctly from a Generic Desktop:Keypad because of its unique keytop markings. All Phone Keys usages are defined as selectors (Sel).</p>
Phone Key 0	Sel	Phone key digit 0 and Oper.
Phone Key 1	Sel	Phone key digit 1.
Phone Key 2	Sel	Phone key digit 2 and A, B, C.
Phone Key 3	Sel	Phone key digit 3 and D, E, F.
Phone Key 4	Sel	Phone key digit 4 and G, H, I.
Phone Key 5	Sel	Phone key digit 5 and J, K, L.
Phone Key 6	Sel	Phone key digit 6 and M, N, O.
Phone Key 7	Sel	Phone key digit 7 and P, Q (optional), R, S.
Phone Key 8	Sel	Phone key digit 8 and T, U, V.
Phone Key 9	Sel	Phone key digit 9 and W, X, Y, Z (optional).
Phone Key Star	Sel	Phone key Star (*).
Phone Key Pound	Sel	Phone key Pound (#).
Phone Key A	Sel	Phone key A
Phone Key B	Sel	Phone key B
Phone Key C	Sel	Phone key C
Phone Key D	Sel	Phone key D
<b>Programmable Button</b>	NArY	<p>Programmable telephone buttons. This collection contains usages from the Button usage page. Programmable Buttons 1 through <math>n</math> are represented by Button page usages 1 through <math>n</math>, respectively.</p>

## 14.3 Call Control

Usage Name	Usage Type	Description
Hook Switch	OOC	Indicates that the handset is Off Hook. Hook Switch is a single bit where 1 is Off Hook.
Flash	MC	Generates a momentary On Hook condition to signal the application. Often used for alternate line selection.
Feature	OSC	Selects operating feature.
Hold	OOC	Places current call on hold.
Redial	OSC	Redials last number dialed.
Transfer	OSC	Transfers call to another extension.
Drop	OSC	Disconnects the active call.
Park	OOC	Waits for free line.
Forward Calls	OOC	Forwards calls to another number.
Alternate Function	MC	A modifier key, similar to a Shift key, that provides an alternate function to be selected on specific buttons. Pressing this button enables the alternate function mapping. Pressing an alternate function key terminates alternate-function mode.
<b>Line</b>	OSC/NArY	Line selection. If the a the phone only supports a single line then the Line usage is defined as an OSC usage type. If the phone supports multiple lines then the Line usage can be defined as a NArY usage type, where the Line usage is applied to a Named Array collection. The Named Array collection contains Ordinal usage selectors, where Ordinal Instances represent the respective line numbers. If a phone can support multiple lines active at once then the Report Count associated with the array item can be greater than 1.
Speaker Phone	OOC	Enables speaker phone mode.
Conference	OOC	Initiates conference call.
Ring Enable	OOC	Enables ringer.
Ring Select	OSC	Selects ring tone. Typically, the caller presses Ring Select, then presses a dial digit to select the tone.
Phone Mute	OOC	Disables audio to the called person. The caller can still hear the incoming audio.
Caller ID	MC	Displays ID of caller.
Send	MC	This indicates that the user has completed entering digits and is ready to begin routing the phone call. Note that this feature will NOT be used to alternate line selection as this is the functionality of the flash button. It should not be used to end the call either, as this is the function of the hook switch.

## 14.4 Speed Dial Controls

<b>Usage Name</b>	<b>Usage Type</b>	<b>Description</b>
Speed Dial	OSC	Initiates speed dial operation.
Store Number	OSC	Saves speed dial number.
Recall Number	OSC	Recalls speed dial number on display.
Phone Directory	OOC	Displays phone directory.

## 14.5 Voice Mail Controls

Usage Name	Usage Type	Description
Voice Mail	OOC	Enters voice mail application.
Screen Calls	OOC	Disables audio to called person and forwards calls to a voice mail application. The caller can still hear the incoming audio.
Do Not Disturb	OOC	Disables ring and speaker phone operation and forwards calls to a voice mail application.
Message	OSC	Listens to voice message.
Answer On/Off	OOC	Toggles answering machine operation.



## 14.6 Locally Generated Tones

Some telephony devices generate tones locally vs. delivering transmitted tones over the audio input. These tones are played to the user via either the handset speaker or the speaker in a speakerphone telephone.

Usage Name	Usage Type	Description
Inside Dial Tone	MC	A tone that indicates to the user that the telephone is ready to place an inside call.
Outside Dial Tone	MC	A tone that indicates to the user that the telephone is ready to place an outside call.
Inside Ring Tone	MC	An in-house destination telephone is ringing.
Outside Ring Tone	MC	An outside destination telephone is ringing.
Priority Ring Tone	MC	The tone generated while a destination telephone is ringing as a result of a programmable function (like autodial, etc).
Inside Ringback	MC	A ringback feature has been activated to an inside line. <sup>1</sup>
Outside Ringback	MC	A ringback feature has been activated to an outside line.
Priority Ringback	MC	A priority ringback feature has been activated.
Line Busy Tone	MC	The destination line is currently busy.
Reorder Tone	MC	There are no lines available for the user to place a call.
Call Waiting Tone	MC	The user is currently on a line, and another phone call is coming in.
Confirmation Tone 1	MC	A feature the user has requested has been enabled. This tone is generated while the user is programming the phone.
Confirmation Tone 2	MC	A feature the user has requested has been enabled. This tone is generated while the user is programming the phone.
Tones Off	OOO	Turn all tones off, negating all control values.
Ringer	OOO	This usage generates the incoming telephone call tone heard by the user while the phone is <i>On Hook</i> . The tone will remain asserted as long as the control is true. Software must negate the control to stop the tone. On/off cycling of the ringer tone is handled by system software, this allows different ring patterns to be generated by the host.

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<sup>1</sup>Ringback is a feature that a user could invoke when the destination is busy. Once the destination hangs up its current call, the destination's phone *places a call* to the original user.

## 14.7 Call History Controls

<b>Usage Name</b>	<b>Usage Type</b>	<b>Description</b>
Phone Call History Key	Sel	Show list of previously dialed phone numbers with associated information (contact list name, time, duration, etc.)
Phone Caller ID Key	Sel	Show list of received calls with associated information (caller ID name, time, duration, etc.)
Phone Settings Key	Sel	Show phone settings screen

## 14.8 Host Dual Mode Phone Controls

Usage Name	Usage Type	Description
Host Control	OOC	Indicates that the host has control of the device.
Host Available	OOC	Indicates to the device that the host is powered on and running the software which is able to control the device.
Host Call Active	OOC	Indicates that the host currently has an active voice call.
Activate Handset Audio	OOC	Indicates that the device should activate its audio channel with the host.
Host Hold	OOC	Indicates that there is a voice call in the hold state on the host.
Email message waiting	OOC	When set indicates that there is email on the host for the account associated with the device.
Voicemail Message Waiting	OOC	When set indicates that there is a voicemail on the host for the account associated with the device.
Phone Locale	DV	A 4 byte value containing the ISO code for the current locale setting of the device. Two most significant bytes are the ASCII character bytes for the ISO 639-1 language code and two least significant bytes are ASCII character bytes for the ISO 3166-1 country code.
Handset Nickname	DV	A name associated with the phone handset for identification. This is a Buffered Byte array in the same format as specified for the Alphanumeric Display usage page and ordering is implied the same was as display data as defined in <a href="#">Section 20.1.4 Character Transfers</a> .
Address Book ID	DV	A unique value stored on the phone to indicate which user of the phone has their contact list currently stored on the device.

## 14.9 Ring Reports

A ring report can be from the device to indicate to the host that a call is arriving on the PSTN line, or from the host to tell the device that a call is arriving on the host. This can also be used by the host to sound notifications on the device.

When a ring report is used to indicate an incoming call, additional information in the report can be caller information (see Section 15.17 [Contact List Controls](#) contact list controls in the consumer usage page) or any of the following usages to provide more detailed information about the call.

Usage Name	Usage Type	Description
<b>Ring Type</b>	NARY	A selectable indicating to the device to start sounding one of the ringer sounds defined below.
PSTN Ring Tone	Sel	Ring associated with a call coming in on the public switched telephone network (PSTN) or standard phone line.
Host Ring Tone	Sel	Ring associated with a voice call coming in on the host.
Alert Sound Error	Sel	Sound associated with an error condition or invalid entry.
Alert Sound Confirm	Sel	Sound associated with a correct or confirmed entry.
Alert Sound Notification	Sel	Sound associated with a notification from the host.
Silent Ring	Sel	No audible sound.
Stop Ring Tone	Sel	Discontinue any previously playing ring sound.
Re-dialable phone number	OOC	Indicates that any phone number in the report is an actual phone number which can be re-dialed and not some other numbers or text which may be present on caller ID.
Phone Time Second	DV	Logical Minimum of 0, Logical Maximum of 59, the seconds part of the call time.
Phone Time Minute	DV	Logical Minimum of 0, Logical Maximum of 59, the minutes part of the call time.
Phone Time Hour	DV	Logical Minimum of 0, Logical Maximum of 23, the hour part of the call time.
Phone Date Day	DV	Logical Minimum of 0, Logical Maximum of 31, the day part of the call time.
Phone Date Month	DV	Logical Minimum of 1, Logical Maximum of 12, the month part of the call time.
Phone Date Year	DV	The year part of the call time. If Logical Minimum is greater than 2000, then the value is a 4-digit date. If Logical Minimum is 0 then the value is a 2-digit date meaning one of the years from 2000 to 2099.

## 14.10 Call History Reports

A dual mode phone can store call history of received and dialed calls. These can be reported to the host using the following usages.

Usage Name	Usage Type	Description
Incoming Call History Count	DV	Indicates the number of incoming caller ID history records are currently stored on the device.
Outgoing Call History Count	DV	Indicates the number of outgoing call history records are currently stored on the device.
Incoming Call History	CL	collection defining an incoming call, which can use the phone time usages defined above, along with the contact list control usages defined in <a href="#">Section 15.17 Contact List Controls</a> .
Outgoing Call History	CL	A collection defining an outgoing call, which can use the phone time usages defined above, along with the contact list control usages defined in <a href="#">Section 15.17 Contact List Controls</a> .
Call Duration	DV	The number of seconds that the call lasted. Zero indicates that the call was not answered.

# 15 Consumer Page (0x0C)

All controls on the Consumer page are application-specific. That is, they affect a specific device, not the system as a whole.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Consumer Control</b>	CA	<a href="#">15.1</a>
02	<b>Numeric Key Pad</b>	NArY	<a href="#">15.2</a>
03	<b>Programmable Buttons</b>	NArY	<a href="#">15.14</a>
04	<b>Microphone</b>	CA	<a href="#">15.1</a>
05	<b>Headphone</b>	CA	<a href="#">15.1</a>
06	<b>Graphic Equalizer</b>	CA	<a href="#">15.1</a>
07-1F	<i>Reserved</i>		
20	+10	OSC	<a href="#">15.2</a>
21	+100	OSC	<a href="#">15.2</a>
22	AM/PM	OSC	<a href="#">15.2</a>
23-2F	<i>Reserved</i>		
30	Power	OOC	<a href="#">15.3</a>
31	Reset	OSC	<a href="#">15.3</a>
32	Sleep	OSC	<a href="#">15.3</a>
33	Sleep After	OSC	<a href="#">15.3</a>
34	Sleep Mode	RTC	<a href="#">15.3</a>
35	Illumination	OOC	<a href="#">15.3</a>
36	<b>Function Buttons</b>	NArY	<a href="#">15.3</a>
37-3F	<i>Reserved</i>		
40	Menu	OOC	<a href="#">15.4</a>
41	Menu Pick	OSC	<a href="#">15.4</a>
42	Menu Up	OSC	<a href="#">15.4</a>
43	Menu Down	OSC	<a href="#">15.4</a>
44	Menu Left	OSC	<a href="#">15.4</a>
45	Menu Right	OSC	<a href="#">15.4</a>
46	Menu Escape	OSC	<a href="#">15.4</a>
47	Menu Value Increase	OSC	<a href="#">15.4</a>
48	Menu Value Decrease	OSC	<a href="#">15.4</a>
49-5F	<i>Reserved</i>		
60	Data On Screen	OOC	<a href="#">15.5</a>
61	Closed Caption	OOC	<a href="#">15.5</a>
62	Closed Caption Select	OSC	<a href="#">15.5</a>
63	VCR/TV	OOC	<a href="#">15.5</a>
64	Broadcast Mode	OSC	<a href="#">15.5</a>
65	Snapshot	OSC	<a href="#">15.5</a>
66	Still	OSC	<a href="#">15.5</a>
67	Picture-in-Picture Toggle <a href="#">[8]</a>	OSC	<a href="#">15.5</a>

68	Picture-in-Picture Swap [8]	OSC	15.5
69	Red Menu Button [9]	MC	15.4
6A	Green Menu Button [9]	MC	15.4
6B	Blue Menu Button [9]	MC	15.4
6C	Yellow Menu Button [9]	MC	15.4
6D	Aspect [10]	OSC	15.5
6E	3D Mode Select [11]	OSC	15.5
6F	Display Brightness Increment [14]	RTC	15.5
70	Display Brightness Decrement [14]	RTC	15.5
71	Display Brightness [14]	LC	15.5
72	Display Backlight Toggle [14]	OOC	15.5
73	Display Set Brightness to Minimum [14]	OSC	15.5
74	Display Set Brightness to Maximum [14]	OSC	15.5
75	Display Set Auto Brightness [14]	OOC	15.5
76	Camera Access Enabled [41]	OOC	15.21
77	Camera Access Disabled [41]	OOC	15.21
78	Camera Access Toggle [41]	OOC	15.21
79	Keyboard Brightness Increment [42]	OSC	15.22
7A	Keyboard Brightness Decrement [42]	OSC	15.22
7B	Keyboard Backlight Set Level [42]	LC	15.22
7C	Keyboard Backlight OOC [42]	OOC	15.22
7D	Keyboard Backlight Set Minimum [42]	OSC	15.22
7E	Keyboard Backlight Set Maximum [42]	OSC	15.22
7F	Keyboard Backlight Auto [42]	OOC	15.22
80	<b>Selection</b>	NAry	15.6
81	Assign Selection	OSC	15.6
82	Mode Step	OSC	15.6
83	Recall Last	OSC	15.6
84	Enter Channel	OSC	15.6
85	Order Movie	OSC	15.6
86	Channel	LC	15.6
87	<b>Media Selection</b>	NAry	15.6
88	Media Select Computer	Sel	15.6
89	Media Select TV	Sel	15.6
8A	Media Select WWW	Sel	15.6
8B	Media Select DVD	Sel	15.6
8C	Media Select Telephone	Sel	15.6
8D	Media Select Program Guide	Sel	15.6
8E	Media Select Video Phone	Sel	15.6
8F	Media Select Games	Sel	15.6

90	Media Select Messages	Sel	15.6
91	Media Select CD	Sel	15.6
92	Media Select VCR	Sel	15.6
93	Media Select Tuner	Sel	15.6
94	Quit	OSC	15.6
95	Help	OOC	15.6
96	Media Select Tape	Sel	15.6
97	Media Select Cable	Sel	15.6
98	Media Select Satellite	Sel	15.6
99	Media Select Security	Sel	15.6
9A	Media Select Home	Sel	15.6
9B	Media Select Call	Sel	15.6
9C	Channel Increment	OSC	15.6
9D	Channel Decrement	OSC	15.6
9E	Media Select SAP	Sel	15.13
9F-9F	<i>Reserved</i>		
A0	VCR Plus	OSC	15.6
A1	Once	OSC	15.6
A2	Daily	OSC	15.6
A3	Weekly	OSC	15.6
A4	Monthly	OSC	15.6
A5-AF	<i>Reserved</i>		
B0	Play	OOC	15.7
B1	Pause	OOC	15.7
B2	Record	OOC	15.7
B3	Fast Forward	OOC	15.7
B4	Rewind	OOC	15.7
B5	Scan Next Track	OSC	15.7
B6	Scan Previous Track	OSC	15.7
B7	Stop	OSC	15.7
B8	Eject	OSC	15.7
B9	Random Play	OOC	15.7
BA	<b>Select Disc</b>	NAry	15.7
BB	Enter Disc	MC	15.7
BC	Repeat	OSC	15.7
BD	Tracking	LC	15.7
BE	Track Normal	OSC	15.7
BF	Slow Tracking	LC	15.7
C0	Frame Forward	RTC	15.7
C1	Frame Back	RTC	15.7
C2	Mark	OSC	15.8
C3	Clear Mark	OSC	15.8
C4	Repeat From Mark	OOC	15.8
C5	Return To Mark	OSC	15.8



C6	Search Mark Forward	OSC	15.8
C7	Search Mark Backwards	OSC	15.8
C8	Counter Reset	OSC	15.8
C9	Show Counter	OSC	15.8
CA	Tracking Increment	RTC	15.7
CB	Tracking Decrement	RTC	15.7
CC	Stop/Eject	OSC	15.7
CD	Play/Pause	OSC	15.7
CE	Play/Skip	OSC	15.7
CF	Voice Command	OSC	15.3
D0	Invoke Capture Interface [35]	Sel	15.20
D1	Start or Stop Game Recording [35]	Sel	15.20
D2	Historical Game Capture [35]	Sel	15.20
D3	Capture Game Screenshot [35]	Sel	15.20
D4	Show or Hide Recording Indicator [35]	Sel	15.20
D5	Start or Stop Microphone Capture [35]	Sel	15.20
D6	Start or Stop Camera Capture [35]	Sel	15.20
D7	Start or Stop Game Broadcast [35]	Sel	15.20
D8-DF	<i>Reserved</i>		
E0	Volume	LC	15.9
E1	Balance	LC	15.9
E2	Mute	OOC	15.9
E3	Bass	LC	15.9
E4	Treble	LC	15.9
E5	Bass Boost	OOC	15.9
E6	Surround Mode	OSC	15.9
E7	Loudness	OOC	15.9
E8	MPX	OOC	15.9
E9	Volume Increment	RTC	15.9
EA	Volume Decrement	RTC	15.9
EB-EF	<i>Reserved</i>		
F0	Speed Select	OSC	15.10
F1	<b>Playback Speed</b>	NArY	15.10
F2	Standard Play	Sel	15.10
F3	Long Play	Sel	15.10
F4	Extended Play	Sel	15.10
F5	Slow	OSC	15.10
F6-FF	<i>Reserved</i>		
100	Fan Enable	OOC	15.11
101	Fan Speed	LC	15.11
102	Light Enable	OOC	15.11
103	Light Illumination Level	LC	15.11
104	Climate Control Enable	OOC	15.11

105	Room Temperature	LC	<a href="#">15.11</a>
106	Security Enable	OOO	<a href="#">15.11</a>
107	Fire Alarm	OSC	<a href="#">15.11</a>
108	Police Alarm	OSC	<a href="#">15.11</a>
109	Proximity	LC	<a href="#">15.11</a>
10A	Motion	OSC	<a href="#">15.11</a>
10B	Duress Alarm	OSC	<a href="#">15.11</a>
10C	Holdup Alarm	OSC	<a href="#">15.11</a>
10D	Medical Alarm	OSC	<a href="#">15.11</a>
10E-14F	<i>Reserved</i>		
150	Balance Right	RTC	<a href="#">15.9</a>
151	Balance Left	RTC	<a href="#">15.9</a>
152	Bass Increment	RTC	<a href="#">15.9</a>
153	Bass Decrement	RTC	<a href="#">15.9</a>
154	Treble Increment	RTC	<a href="#">15.9</a>
155	Treble Decrement	RTC	<a href="#">15.9</a>
156-15F	<i>Reserved</i>		
160	<b>Speaker System</b>	CL	<a href="#">15.12</a>
161	<b>Channel Left</b>	CL	<a href="#">15.12</a>
162	<b>Channel Right</b>	CL	<a href="#">15.12</a>
163	<b>Channel Center</b>	CL	<a href="#">15.12</a>
164	<b>Channel Front</b>	CL	<a href="#">15.12</a>
165	<b>Channel Center Front</b>	CL	<a href="#">15.12</a>
166	<b>Channel Side</b>	CL	<a href="#">15.12</a>
167	<b>Channel Surround</b>	CL	<a href="#">15.12</a>
168	<b>Channel Low Frequency Enhancement</b>	CL	<a href="#">15.12</a>
169	<b>Channel Top</b>	CL	<a href="#">15.12</a>
16A	<b>Channel Unknown</b>	CL	<a href="#">15.12</a>
16B-16F	<i>Reserved</i>		
170	Sub-channel	LC	<a href="#">15.13</a>
171	Sub-channel Increment	OSC	<a href="#">15.13</a>
172	Sub-channel Decrement	OSC	<a href="#">15.13</a>
173	Alternate Audio Increment	OSC	<a href="#">15.13</a>
174	Alternate Audio Decrement	OSC	<a href="#">15.13</a>
175-17F	<i>Reserved</i>		
180	<b>Application Launch Buttons</b>	NAry	<a href="#">15.15</a>
181	AL Launch Button Configuration Tool	Sel	<a href="#">15.15</a>
182	AL Programmable Button Configuration	Sel	<a href="#">15.15</a>
183	AL Consumer Control Configuration	Sel	<a href="#">15.15</a>
184	AL Word Processor	Sel	<a href="#">15.15</a>
185	AL Text Editor	Sel	<a href="#">15.15</a>
186	AL Spreadsheet	Sel	<a href="#">15.15</a>
187	AL Graphics Editor	Sel	<a href="#">15.15</a>
188	AL Presentation App	Sel	<a href="#">15.15</a>

189	AL Database App	Sel	<a href="#">15.15</a>
18A	AL Email Reader	Sel	<a href="#">15.15</a>
18B	AL Newsreader	Sel	<a href="#">15.15</a>
18C	AL Voicemail	Sel	<a href="#">15.15</a>
18D	AL Contacts/Address Book	Sel	<a href="#">15.15</a>
18E	AL Calendar/Schedule	Sel	<a href="#">15.15</a>
18F	AL Task/Project Manager	Sel	<a href="#">15.15</a>
190	AL Log/Journal/Timecard	Sel	<a href="#">15.15</a>
191	AL Checkbook/Finance	Sel	<a href="#">15.15</a>
192	AL Calculator	Sel	<a href="#">15.15</a>
193	AL A/V Capture/Playback	Sel	<a href="#">15.15</a>
194	AL Local Machine Browser	Sel	<a href="#">15.15</a>
195	AL LAN/WAN Browser	Sel	<a href="#">15.15</a>
196	AL Internet Browser	Sel	<a href="#">15.15</a>
197	AL Remote Networking/ISP Connect	Sel	<a href="#">15.15</a>
198	AL Network Conference	Sel	<a href="#">15.15</a>
199	AL Network Chat	Sel	<a href="#">15.15</a>
19A	AL Telephony/Dialer	Sel	<a href="#">15.15</a>
19B	AL Logon	Sel	<a href="#">15.15</a>
19C	AL Logoff	Sel	<a href="#">15.15</a>
19D	AL Logon/Logoff	Sel	<a href="#">15.15</a>
19E	AL Terminal Lock/Screensaver	Sel	<a href="#">15.15</a>
19F	AL Control Panel	Sel	<a href="#">15.15</a>
1A0	AL Command Line Processor/Run	Sel	<a href="#">15.15</a>
1A1	AL Process/Task Manager	Sel	<a href="#">15.15</a>
1A2	AL Select Task/Application	Sel	<a href="#">15.15</a>
1A3	AL Next Task/Application	Sel	<a href="#">15.15</a>
1A4	AL Previous Task/Application	Sel	<a href="#">15.15</a>
1A5	AL Preemptive Halt Task/Application	Sel	<a href="#">15.15</a>
1A6	AL Integrated Help Center	Sel	<a href="#">15.15</a>
1A7	AL Documents	Sel	<a href="#">15.15</a>
1A8	AL Thesaurus	Sel	<a href="#">15.15</a>
1A9	AL Dictionary	Sel	<a href="#">15.15</a>
1AA	AL Desktop	Sel	<a href="#">15.15</a>
1AB	AL Spell Check	Sel	<a href="#">15.15</a>
1AC	AL Grammar Check	Sel	<a href="#">15.15</a>
1AD	AL Wireless Status	Sel	<a href="#">15.15</a>
1AE	AL Keyboard Layout	Sel	<a href="#">15.15</a>
1AF	AL Virus Protection	Sel	<a href="#">15.15</a>
1B0	AL Encryption	Sel	<a href="#">15.15</a>
1B1	AL Screen Saver	Sel	<a href="#">15.15</a>
1B2	AL Alarms	Sel	<a href="#">15.15</a>

1B3	AL Clock	Sel	15.15
1B4	AL File Browser	Sel	15.15
1B5	AL Power Status	Sel	15.15
1B6	AL Image Browser	Sel	15.15
1B7	AL Audio Browser	Sel	15.15
1B8	AL Movie Browser	Sel	15.15
1B9	AL Digital Rights Manager	Sel	15.15
1BA	AL Digital Wallet	Sel	15.15
1BB-1BB	<i>Reserved</i>		
1BC	AL Instant Messaging	Sel	15.15
1BD	AL OEM Features/ Tips/Tutorial Browser	Sel	15.15
1BE	AL OEM Help	Sel	15.15
1BF	AL Online Community	Sel	15.15
1C0	AL Entertainment Content Browser	Sel	15.15
1C1	AL Online Shopping Browser	Sel	15.15
1C2	AL SmartCard Information/Help	Sel	15.15
1C3	AL Market Monitor/Finance Browser	Sel	15.15
1C4	AL Customized Corporate News Browser	Sel	15.15
1C5	AL Online Activity Browser	Sel	15.15
1C6	AL Research/Search Browser	Sel	15.15
1C7	AL Audio Player	Sel	15.15
1C8	AL Message Status [5]	Sel	15.15
1C9	AL Contact Sync [5]	Sel	15.15
1CA	AL Navigation [64]	Sel	15.15
1CB	AL Context-aware Desktop Assistant [56]	Sel	15.15
1CC-1FF	<i>Reserved</i>		
200	<b>Generic GUI Application Controls</b>	NArY	15.16
201	AC New	Sel	15.16
202	AC Open	Sel	15.16
203	AC Close	Sel	15.16
204	AC Exit	Sel	15.16
205	AC Maximize	Sel	15.16
206	AC Minimize	Sel	15.16
207	AC Save	Sel	15.16
208	AC Print	Sel	15.16
209	AC Properties	Sel	15.16
20A-219	<i>Reserved</i>		
21A	AC Undo	Sel	15.16
21B	AC Copy	Sel	15.16
21C	AC Cut	Sel	15.16
21D	AC Paste	Sel	15.16
21E	AC Select All	Sel	15.16
21F	AC Find	Sel	15.16

220	AC Find and Replace	Sel	<a href="#">15.16</a>
221	AC Search	Sel	<a href="#">15.16</a>
222	AC Go To	Sel	<a href="#">15.16</a>
223	AC Home	Sel	<a href="#">15.16</a>
224	AC Back	Sel	<a href="#">15.16</a>
225	AC Forward	Sel	<a href="#">15.16</a>
226	AC Stop	Sel	<a href="#">15.16</a>
227	AC Refresh	Sel	<a href="#">15.16</a>
228	AC Previous Link	Sel	<a href="#">15.16</a>
229	AC Next Link	Sel	<a href="#">15.16</a>
22A	AC Bookmarks	Sel	<a href="#">15.16</a>
22B	AC History	Sel	<a href="#">15.16</a>
22C	AC Subscriptions	Sel	<a href="#">15.16</a>
22D	AC Zoom In	Sel	<a href="#">15.16</a>
22E	AC Zoom Out	Sel	<a href="#">15.16</a>
22F	AC Zoom	LC	<a href="#">15.16</a>
230	AC Full Screen View	Sel	<a href="#">15.16</a>
231	AC Normal View	Sel	<a href="#">15.16</a>
232	AC View Toggle	Sel	<a href="#">15.16</a>
233	AC Scroll Up	Sel	<a href="#">15.16</a>
234	AC Scroll Down	Sel	<a href="#">15.16</a>
235	AC Scroll	LC	<a href="#">15.16</a>
236	AC Pan Left	Sel	<a href="#">15.16</a>
237	AC Pan Right	Sel	<a href="#">15.16</a>
238	AC Pan	LC	<a href="#">15.16</a>
239	AC New Window	Sel	<a href="#">15.16</a>
23A	AC Tile Horizontally	Sel	<a href="#">15.16</a>
23B	AC Tile Vertically	Sel	<a href="#">15.16</a>
23C	AC Format	Sel	<a href="#">15.16</a>
23D	AC Edit	Sel	<a href="#">15.16</a>
23E	AC Bold	Sel	<a href="#">15.16</a>
23F	AC Italics	Sel	<a href="#">15.16</a>
240	AC Underline	Sel	<a href="#">15.16</a>
241	AC Strikethrough	Sel	<a href="#">15.16</a>
242	AC Subscript	Sel	<a href="#">15.16</a>
243	AC Superscript	Sel	<a href="#">15.16</a>
244	AC All Caps	Sel	<a href="#">15.16</a>
245	AC Rotate	Sel	<a href="#">15.16</a>
246	AC Resize	Sel	<a href="#">15.16</a>
247	AC Flip Horizontal	Sel	<a href="#">15.16</a>
248	AC Flip Vertical	Sel	<a href="#">15.16</a>
249	AC Mirror Horizontal	Sel	<a href="#">15.16</a>
24A	AC Mirror Vertical	Sel	<a href="#">15.16</a>
24B	AC Font Select	Sel	<a href="#">15.16</a>

24C	AC Font Color	Sel	<a href="#">15.16</a>
24D	AC Font Size	Sel	<a href="#">15.16</a>
24E	AC Justify Left	Sel	<a href="#">15.16</a>
24F	AC Justify Center H	Sel	<a href="#">15.16</a>
250	AC Justify Right	Sel	<a href="#">15.16</a>
251	AC Justify Block H	Sel	<a href="#">15.16</a>
252	AC Justify Top	Sel	<a href="#">15.16</a>
253	AC Justify Center V	Sel	<a href="#">15.16</a>
254	AC Justify Bottom	Sel	<a href="#">15.16</a>
255	AC Justify Block V	Sel	<a href="#">15.16</a>
256	AC Indent Decrease	Sel	<a href="#">15.16</a>
257	AC Indent Increase	Sel	<a href="#">15.16</a>
258	AC Numbered List	Sel	<a href="#">15.16</a>
259	AC Restart Numbering	Sel	<a href="#">15.16</a>
25A	AC Bulleted List	Sel	<a href="#">15.16</a>
25B	AC Promote	Sel	<a href="#">15.16</a>
25C	AC Demote	Sel	<a href="#">15.16</a>
25D	AC Yes	Sel	<a href="#">15.16</a>
25E	AC No	Sel	<a href="#">15.16</a>
25F	AC Cancel	Sel	<a href="#">15.16</a>
260	AC Catalog	Sel	<a href="#">15.16</a>
261	AC Buy/Checkout	Sel	<a href="#">15.16</a>
262	AC Add to Cart	Sel	<a href="#">15.16</a>
263	AC Expand	Sel	<a href="#">15.16</a>
264	AC Expand All	Sel	<a href="#">15.16</a>
265	AC Collapse	Sel	<a href="#">15.16</a>
266	AC Collapse All	Sel	<a href="#">15.16</a>
267	AC Print Preview	Sel	<a href="#">15.16</a>
268	AC Paste Special	Sel	<a href="#">15.16</a>
269	AC Insert Mode	Sel	<a href="#">15.16</a>
26A	AC Delete	Sel	<a href="#">15.16</a>
26B	AC Lock	Sel	<a href="#">15.16</a>
26C	AC Unlock	Sel	<a href="#">15.16</a>
26D	AC Protect	Sel	<a href="#">15.16</a>
26E	AC Unprotect	Sel	<a href="#">15.16</a>
26F	AC Attach Comment	Sel	<a href="#">15.16</a>
270	AC Delete Comment	Sel	<a href="#">15.16</a>
271	AC View Comment	Sel	<a href="#">15.16</a>
272	AC Select Word	Sel	<a href="#">15.16</a>
273	AC Select Sentence	Sel	<a href="#">15.16</a>
274	AC Select Paragraph	Sel	<a href="#">15.16</a>
275	AC Select Column	Sel	<a href="#">15.16</a>
276	AC Select Row	Sel	<a href="#">15.16</a>
277	AC Select Table	Sel	<a href="#">15.16</a>

278	AC Select Object	Sel	<a href="#">15.16</a>
279	AC Redo/Repeat	Sel	<a href="#">15.16</a>
27A	AC Sort	Sel	<a href="#">15.16</a>
27B	AC Sort Ascending	Sel	<a href="#">15.16</a>
27C	AC Sort Descending	Sel	<a href="#">15.16</a>
27D	AC Filter	Sel	<a href="#">15.16</a>
27E	AC Set Clock	Sel	<a href="#">15.16</a>
27F	AC View Clock	Sel	<a href="#">15.16</a>
280	AC Select Time Zone	Sel	<a href="#">15.16</a>
281	AC Edit Time Zones	Sel	<a href="#">15.16</a>
282	AC Set Alarm	Sel	<a href="#">15.16</a>
283	AC Clear Alarm	Sel	<a href="#">15.16</a>
284	AC Snooze Alarm	Sel	<a href="#">15.16</a>
285	AC Reset Alarm	Sel	<a href="#">15.16</a>
286	AC Synchronize	Sel	<a href="#">15.16</a>
287	AC Send/Receive	Sel	<a href="#">15.16</a>
288	AC Send To	Sel	<a href="#">15.16</a>
289	AC Reply	Sel	<a href="#">15.16</a>
28A	AC Reply All	Sel	<a href="#">15.16</a>
28B	AC Forward Msg	Sel	<a href="#">15.16</a>
28C	AC Send	Sel	<a href="#">15.16</a>
28D	AC Attach File	Sel	<a href="#">15.16</a>
28E	AC Upload	Sel	<a href="#">15.16</a>
28F	AC Download (Save Target As)	Sel	<a href="#">15.16</a>
290	AC Set Borders	Sel	<a href="#">15.16</a>
291	AC Insert Row	Sel	<a href="#">15.16</a>
292	AC Insert Column	Sel	<a href="#">15.16</a>
293	AC Insert File	Sel	<a href="#">15.16</a>
294	AC Insert Picture	Sel	<a href="#">15.16</a>
295	AC Insert Object	Sel	<a href="#">15.16</a>
296	AC Insert Symbol	Sel	<a href="#">15.16</a>
297	AC Save and Close	Sel	<a href="#">15.16</a>
298	AC Rename	Sel	<a href="#">15.16</a>
299	AC Merge	Sel	<a href="#">15.16</a>
29A	AC Split	Sel	<a href="#">15.16</a>
29B	AC Distribute Horizontally	Sel	<a href="#">15.16</a>
29C	AC Distribute Vertically	Sel	<a href="#">15.16</a>
29D	AC Next Keyboard Layout Select <a href="#">[28]</a>	Sel	<a href="#">15.16</a>
29E	AC Navigation Guidance <a href="#">[44]</a>	Sel	<a href="#">15.16</a>
29F	AC Desktop Show All Windows <a href="#">[46]</a>	Sel	<a href="#">15.16</a>
2A0	AC Soft Key Left <a href="#">[5]</a>	Sel	<a href="#">15.16</a>
2A1	AC Soft Key Right <a href="#">[5]</a>	Sel	<a href="#">15.16</a>
2A2	AC Desktop Show All Applications <a href="#">[64]</a>	Sel	<a href="#">15.16</a>

2A3-2AF	<i>Reserved</i>		
2B0	AC Idle Keep Alive [5]	Sel	15.16
2B1-2BF	<i>Reserved</i>		
2C0	Extended Keyboard Attributes Collection [15]	CL	15.18
2C1	Keyboard Form Factor [15]	SV	15.18
2C2	Keyboard Key Type [15]	SV	15.18
2C3	Keyboard Physical Layout [15]	SV	15.18
2C4	Vendor-Specific Keyboard Physical Layout [15]	SV	15.18
2C5	Keyboard IETF Language Tag Index [15]	SV	15.18
2C6	Implemented Keyboard Input Assist Controls [15]	SV	15.18
2C7	Keyboard Input Assist Previous [15]	Sel	15.19
2C8	Keyboard Input Assist Next [15]	Sel	15.19
2C9	Keyboard Input Assist Previous Group [15]	Sel	15.19
2CA	Keyboard Input Assist Next Group [15]	Sel	15.19
2CB	Keyboard Input Assist Accept [15]	Sel	15.19
2CC	Keyboard Input Assist Cancel [15]	Sel	15.19
2CD-2CF	<i>Reserved</i>		
2D0	Privacy Screen Toggle [62]	OOC	15.23
2D1	Privacy Screen Level Decrement [62]	RTC	15.23
2D2	Privacy Screen Level Increment [62]	RTC	15.23
2D3	Privacy Screen Level Minimum [62]	OSC	15.23
2D4	Privacy Screen Level Maximum [62]	OSC	15.23
2D5-4FF	<i>Reserved</i>		
500	Contact Edited [5]	OOC	15.17
501	Contact Added [5]	OOC	15.17
502	Contact Record Active [5]	OOC	15.17
503	Contact Index [5]	DV	15.17
504	Contact Nickname [5]	DV	15.17
505	Contact First Name [5]	DV	15.17
506	Contact Last Name [5]	DV	15.17
507	Contact Full Name [5]	DV	15.17
508	Contact Phone Number Personal [5]	DV	15.17
509	Contact Phone Number Business [5]	DV	15.17
50A	Contact Phone Number Mobile [5]	DV	15.17
50B	Contact Phone Number Pager [5]	DV	15.17
50C	Contact Phone Number Fax [5]	DV	15.17
50D	Contact Phone Number Other [5]	DV	15.17
50E	Contact Email Personal [5]	DV	15.17
50F	Contact Email Business [5]	DV	15.17



510	Contact Email Other [5]	DV	<a href="#">15.17</a>
511	Contact Email Main [5]	DV	<a href="#">15.17</a>
512	Contact Speed Dial Number [5]	DV	<a href="#">15.17</a>
513	Contact Status Flag [5]	DV	<a href="#">15.17</a>
514	Contact Misc. [5]	DV	<a href="#">15.17</a>
515-FFFF	<i>Reserved</i>		

Table 15.1: Consumer Page

## 15.1 Generic Consumer Control Device

Usage Name	Usage Type	Description
<b>Consumer Control</b>	CA	General consumer control device.
<b>Microphone</b>	CA	Names a collection that contains usages related to an audio receiver device for recording or amplifying sounds. This usage can also be used to name a logical collection (CL) if the microphone controls are part of another device.
<b>Headphone</b>	CA	Names a collection that contains usages related to an audio output device for playing back sounds. This usage can also be used to name a logical collection (CL) if the headphone controls are part of another device.
<b>Graphic Equalizer</b>	CA	This collection contains Ordinal usages. An Ordinal usage is declared for each frequency band gain control supported by the Graphic Equalizer. The value associate with the ordinal determines the gain of an individual band in an graphic equalizer. The gain varies from 0 to 100% of the total gain supported by the band. This usage requires the definition of a Usage Descriptor to identify the center frequency and Q of the filter associated with the band. This usage can also be used to name a logical collection (CL) if the equalizer controls are part of another device.

Part	Offset (Bytes)	Size (Bytes)	Value	Description
bLength	0	1	Number	Size of this descriptor in bytes (0x0A)
bDescriptorType	1	1	Constant	String descriptor type (0x03)
fCenterFreq	2	4	IEEE 32-bit floating-point	Defines the center frequency of the equalizer band in Hertz
fQ	6	4	IEEE 32-bit floating-point	Defines the Q factor of the equalizer band.

Table 15.3: Graphic Equalizer Data Descriptor

Both the Center Frequency and the Q members of the Graphic Equalizer Usage Descriptor are defined in standard IEEE 32-bit floating-point format.

## 15.2 Numeric Key Pad

Usage Name	Usage Type	Description
<b>Numeric Key Pad</b>	NArY	A collection usage for a generic numeric keypad. On a consumer device these are commonly used for channel selection. Usages for digits can be found on the Button page where numeric values starting with 0 are assigned to Button 1, numeric value 1 to Button 2, and so on.
+10	OSC	Increments channel by 10.
+100	OSC	Increments channel by 100.
AM/PM	OSC	Toggles between AM and PM for time entry.

## 15.3 General Controls

Usage Name	Usage Type	Description
Power	OOC	Controls the application-specific power state. For global power control, see <a href="#">Section 4.5 System Controls</a> .
Reset	OSC	Resets the device. All volatile settings revert to the defaults.
Sleep	OSC	Initiates low power state on application-specific device now.
Sleep After	OSC	Sets inactivity timeout to a value. The Sleep After button will be followed with the timeout value in minutes entered on a numeric keypad.
Sleep Mode	RTC	Cycle through available sleep delays, such as no sleeping, 5 minutes, 10 minutes, 30 minutes, etc... The last selected mode will be enabled.
Illumination	OOC	Toggles illumination of consumer control's buttons and controls on/off.
<b>Function Buttons</b>	NArY	A collection usage for generic function buttons. On a consumer device, these are commonly used for user-assigned functions. Usages for function buttons can be found on <a href="#">Section 12 Button Page (0x09)</a> where Function Button 1 is assigned to Button 1, Function Button 2 to Button 2, and so on.
Voice Command	OSC	Initiates listening for Voice Command.

## 15.4 Menu Controls

Usage Name	Usage Type	Description
Menu	OOC	Initiates on-device-display main menu. Sets a mode in which the other menu controls are active. In this mode, a subsequent menu press will cancel the mode.
Menu Pick	OSC	Picks an item from an on-screen menu.
Menu Up	OSC	Moves the selection up in a device-displayed menu.
Menu Down	OSC	Moves the selection down in a device-displayed menu.
Menu Left	OSC	Moves the selection left in a device-displayed menu.
Menu Right	OSC	Moves the selection right in a device-displayed menu.
Menu Escape	OSC	Backs up a level in the on-screen menu system.
Menu Value Increase	OSC	Increments the value of the currently selected menu item. For example, after using a menu to select a volume control, the user can modify the volume level using this control.
Menu Value Decrease	OSC	Decrements the value of the currently selected menu item.
Red Menu Button	MC	Red menu button on the remote control is currently pressed.
Green Menu Button	MC	Green menu button on the remote control is currently pressed.
Blue Menu Button	MC	Blue menu button on the remote control is currently pressed.
Yellow Menu Button	MC	Yellow menu button on the remote control is currently pressed.

## 15.5 Display Controls

Usage Name	Usage Type	Description
Data On Screen	OOC	Superimposes state data on the monitor video. Typically, channel information is displayed.
Closed Caption	OOC	Enables closed-caption display.
Closed Caption Select	OSC	Cycles through closed-caption viewing options.
VCR/TV	OOC	Selects a recording source for VCR.
Broadcast Mode	OSC	Cycles between available broadcast modes, such as Broadcast, CATV, etc. The last selected mode is enabled.
Snapshot	OSC	Captures the screen or image of the currently selected window.
Still	OSC	Pauses playback in the currently selected window.
Picture-in-Picture Toggle	OSC	Toggles the Picture-in-Picture feature on and off. In typical usage, if the overlaid picture-in-picture video is not currently visible, then it becomes visible, and if it is currently visible, then it is made not visible. Optionally, upon receipt of this control the host device may cycle through multiple picture-in-picture options. For example the host may cycle through various positions of the embedded picture on the screen before cycling back to the state in which the picture-in-picture image is not visible.
Picture-in-Picture Swap	OSC	Swaps the video sources used for the main and embedded display if the picture-in-picture feature is currently enabled on the receiving device. If the picture-in-picture feature is not enabled at the time of the receipt of this control, no action should result.
Aspect	OSC	Selects the next available supported aspect ratio option on a device which outputs or displays video. For example, common aspect ratio options are 4:3 (standard definition), 16:9 (often used to stretch a standard definition source signal to a 16:9 video screen), letter-box and anamorphic widescreen. The order in which the aspect ratios are selected is implementation specific.
3D Mode Select	OSC	Selects the next available supported 3D mode on a TV or other device which displays or outputs 3D video. For example, common modes are 3D disabled, sequential frame, left-over-right format and side-by-side format. The supported modes and the order in which the device cycles through these modes is implementation specific.
Display Brightness Increment	RTC	Brightens the display by one unit, if possible.
Display Brightness Decrement	RTC	Dims the display by one unit, until off.
Display Brightness	LC	Sets brightness to a value between logical min and max. Logical min is off, logical max is brightest.
Display Backlight Toggle	OOC	Toggles the backlight state between off and last known brightness or default brightness if last known is unavailable.
Display Set Brightness to Minimum	OSC	Dims the display to minimum brightness (not off).
Display Set Brightness to Maximum	OSC	Brightens the display to maximum brightness.
Display Set Auto Brightness	OOC	Permits the display to automatically control brightness.

## 15.6 Selection Controls

Usage Name	Usage Type	Description
<b>Selection</b>	NArY	A collection usage for a number of discrete selections. On a consumer device, these are commonly used for <i>favorite</i> selections. Usages for the selections can be found on the Button page where the choices are assigned to Button 1 and so on.
Assign Selection	OSC	This button works in conjunction with the <b>Selection</b> usage. To assign the current channel or mode to a selection button, the user presses the Assign Selection button followed by a button in the <b>Selection</b> named array.
Mode Step	OSC	Steps through devices (TV, VCR, cable) in a multi-mode remote.
Recall Last	OSC	Returns to the last selected channel or mode.
Enter Channel	OSC	Interprets the previous number entry as channel information.
Order Movie	OSC	Requests pay-per-view entertainment.
Channel	LC	Channel selection control where the range of possible values is equal to the number of channels supported by the device.
Channel Increment	OSC	Channel control where each activation of the control increments the current channel selection to the next available channel.
Channel Decrement	OSC	Channel control where each activation of the control decrements the current channel selection to the next available channel.
VCR Plus	OSC	Initiates (and optionally terminates) VCR Plus code entry mode.
Once <sup>1</sup>	OSC	Performs the operation once.
Daily	OSC	Performs the operation once a day.
Weekly	OSC	Performs the operation once a week.
Monthly	OSC	Performs the operation once a month.
<b>Media Selection</b>	NArY	Identifies the media source to be manipulated or displayed. This collection will contain one of the following Media Select usages.
Media Select Computer	Sel	Selects the computer display.
Media Select TV	Sel	Selects the television display.
Media Select WWW	Sel	Selects World Wide Web access.
Media Select DVD	Sel	Selects the DVD drive.
Media Select Telephone	Sel	Selects telephone mode.
Media Select Program Guide	Sel	Selects the viewing guide.
Media Select Video Phone	Sel	Selects videophone mode.
Media Select Games	Sel	Selects gaming mode.
Media Select Messages	Sel	Selects message mode.
Media Select CD	Sel	Selects the CD drive.
Media Select VCR	Sel	Selects the VCR.
Media Select Tuner	Sel	Selects the tuner.
Media Select Tape	Sel	Select the audio tape.
Media Select Cable	Sel	Selects the cable receiver.
Media Select Satellite	Sel	Selects the satellite receiver.
Media Select Security	Sel	Selects the security status display.

<sup>1</sup>The controls Once, Daily, Weekly, and Monthly are typically used for programming record operations.

Media Select Home	Sel	Selects the home system status display.
Media Select Call	Sel	Selects the telephone call status display.
Quit	OSC	Exits the current mode.
Help	OOC	Displays the help screen.



## 15.7 Transport Controls

Usage Name	Usage Type	Description
Play	OOC	Begins streaming linear media.
Pause	OOC	Stops streaming linear media.
Record	OOC	Initiates transferring input data to media.
Fast Forward	OOC	Initiates fast forward scan of linear media.
Rewind	OOC	Initiates fast reverse scan of linear media.
Scan Next Track	OSC	Moves to the next chapter or track boundary.
Scan Previous Track	OSC	Moves to the previous chapter or track boundary.
Stop	OSC	Halts scanning, streaming, or recording linear media.
Eject	OSC	Removes media from the player.
Stop/Eject	OSC	If linear media is scanning, streaming, or recording, stops the media stream. If linear media is halted, removes the media from the player.
Play/Pause	OSC	If linear media is scanning, streaming, or recording, momentarily stops the media stream. If linear media is paused, resumes streaming.
Play/Skip	OSC	If linear media is halted, begins streaming. If linear media is already streaming, advances to the next channel.
Random Play	OOC	Random selection of tracks.
Repeat	OSC	Repeat selection of tracks.
<b>Select Disc</b>	NArY	Attached to a collection that defines the selection of one of many disks. The allowed disk numbers are enumerated with the declaration of ordinals in the <b>Select Disc</b> named array.
Enter Disc	MC	This button works in conjunction with the <b>Numeric Key Pad</b> usage. To select a disk, the user presses the Enter Disc button followed by the entry of the desired disc number on the numeric key pad.
Tracking	LC	Adjusts media tracking.
Tracking Increment	RTC	Asserting this control increments the current value of media tracking until the maximum value is reached. Typically implemented as a single button.
Tracking Decrement	RTC	Asserting this control decrements the current value of media tracking until the minimum value is reached. Typically implemented as a single button.
Track Normal	OSC	Sets media tracking to default or automatic value.
Slow Tracking	LC	Adjusts media slow tracking.
Frame Forward	RTC	Moves forward one video frame.
Frame Back	RTC	Moves back one video frame.

## 15.8 Search Controls

Search controls either place a physical flag, index or mark on the magnetic media, or use the position or frame counter to flag points of interest. The search controls allow identifying and moving between these points of interest.

Usage Name	Usage Type	Description
Mark	OSC	Marks a reference point on the media. Synonymous with the <i>counter memory</i> function found on some transport devices.
Clear Mark	OSC	Removes a marked reference point from the media.
Repeat From Mark	OOC	Marks the current position as the end of the block and repeat-plays the block starting from the marked beginning of the block.
Return To Mark	OSC	Positions at the last detected mark and plays.
Search Mark Forward	OSC	Searches forward for a mark.
Search Mark Backwards	OSC	Searches backward for a mark.
Counter Reset	OSC	Resets the time, position, or frame counter.
Show Counter	OSC	Toggles between the position counter and the time display.

## 15.9 Audio Controls

### 15.9.1 Volume

An application should check the Volume, Volume Increment and Volume Decrement usages when determining whether a device supports volume controls.

Usage Name	Usage Type	Description
Volume	LC	Audio volume control.
Volume Increment	RTC	Asserting this control increments the current value of audio volume until the maximum value is reached. It is typically implemented as a single button.
Volume Decrement	RTC	Asserting this control decrements the current value of audio volume until the minimum value is reached. It is typically implemented as a single button.
Mute	OOC	Audio mute control. Sets the audio output level to the minimum value without affecting the current volume level. When Mute is disabled, the previous audio level will be restored.

### 15.9.2 Balance

An application should check the Balance, Balance Right and Balance Left usages when determining whether a device supports balance controls.

Usage Name	Usage Type	Description
Balance	LC	Audio balance control.
Balance Right	RTC	Asserting this control adjusts the audio output towards the right channel until the maximum value is reached. It is typically implemented as a single button.
Balance Left	RTC	Asserting this control adjusts the audio to the left channel until the maximum value is reached. It is typically implemented as a single button.

### 15.9.3 Bass

An application should check the Bass, Bass Increment and Bass Decrement usages when determining whether a device supports bass controls.

Usage Name	Usage Type	Description
Bass	LC	Audio bass control.
Bass Increment	RTC	Asserting this control increments the current value of the audio bass control until the maximum value is reached. It is typically implemented as a single button.
Bass Decrement	RTC	Asserting this control decrements the current value of the audio bass control until the minimum value is reached. It is typically implemented as a single button.
Bass Boost	OOC	Enables audio bass boost.

### 15.9.4 Treble

An application should check the Treble, Treble Increment and Treble Decrement usages when determining whether a device supports treble controls.

Usage Name	Usage Type	Description
Treble	LC	Audio treble control.
Treble Increment	RTC	Asserting this control increments the current value of the audio treble control until the maximum value is reached. It is typically implemented as a single button.
Treble Decrement	RTC	Asserting this control decrements the current value of the audio treble control until the minimum value is reached. It is typically implemented as a single button.

### 15.9.5 Other

Usage Name	Usage Type	Description
Surround Mode	OSC	Steps through surround mode options.
Loudness	OOC	Applies boost to audio bass and treble.
MPX	OOC	Enables stereo multiplexer.

## 15.10 Speed Controls

Usage Name	Usage Type	Description
Speed Select	OSC	Cycles through media speed options.
<b>Playback Speed</b>	NArY	A collection of controls that allow adjustment of playback speed (in units relative to normal playback speed). Contains the selectors Standard, Long, and Extended Play.
Standard Play	Sel	Selects the VCR's <i>SP</i> recording speed.
Long Play	Sel	Selects the VCR's <i>LP</i> recording speed.
Extended Play	Sel	Selects the VCR's <i>EP</i> recording speed.
Slow	OSC	Enables slow speed transport motion.

## 15.11 Home and Security Controls

Usage Name	Usage Type	Description
Fan Enable	OOC	Controls the state of a overhead, furnace, or ventilation fan.
Fan Speed	LC	Adjusts the speed of a overhead, furnace or ventilation fan.
Light Enable	OOC	Controls the state of a light or lamp.
Light Illumination Level	LC	Adjusts the illumination level of a light or lamp.
Climate Control Enable	OOC	Enables or disables a climate control system.
Room Temperature	LC	Adjusts room temperature level.
Security Enable	OOC	Enables or disables a security system.
Fire Alarm	OSC	Initiates a fire alarm.
Police Alarm	OSC	Initiates a police alarm.
Proximity	LC	A value indicating proximity to a sensor.
Motion	OSC	A value indicating detection of motion.
Duress Alarm	OSC	Initiates a Panic alarm Indicates a forced operation of the alarm controls under duress. Typically a silent alarm.
Holdup Alarm	OSC	Initiates a Holdup alarm. Typically a silent alarm.
Medical Alarm	OSC	Initiates a Medical alarm.

## 15.12 Speaker Channels

USB speaker systems may employ a hierarchy of Channel collections to identify controls that effect individual speakers or subsets of speakers. The selection of collections also allows the speakers associated with USB audio class spatial locations to be identified.

If the only function provided by a device is a speaker system, then it will be defined as a Consumer Control at the application collection level. The volume, balance, mute, and tone control usages found at the top level represent *Master* controls that effect all channels or speaker systems. If more spatial resolution is required then Channel collections can be contained in the top-level collection.

Channel identification assumes the following layout of the speakers.

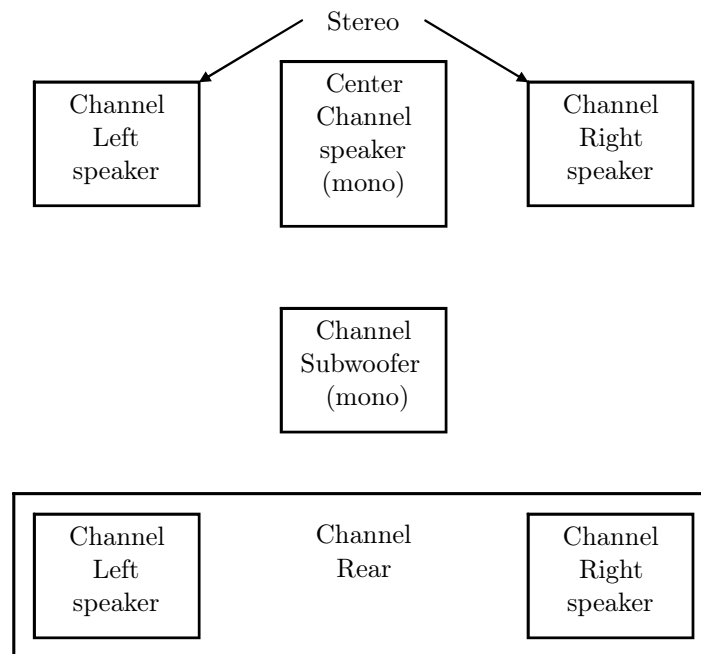


Figure 15.1: Audio Channels

### 15.12.1 Audio Channels

Where

- A monophonic system is a 1-channel system that would be represented by volume, mute and tone controls in the top-level collection.
- Stereo is a 2-channel system. Normally volume, balance, mute and tone controls in the top-level collection would represent this configuration. However if a device provided individual controls for the right and left channels then these controls would be found in their respective Right Channel and Left Channel collections.
- Dolby Surround is a 3-channel system with Right, Left, and Rear Channels. This configuration is very similar to a stereo configuration however any controls that only effected the rear speakers would be found in a Surround Channel collection.
- Dolby Pro-Logic surround is a 4-channel system with Right, Left, Center, and Rear Channels. Similar to Dolby Surround however any controls that only effected the center speaker would be found in a Center Front Channel collection.
- Dolby Digital is a 6-channel system with 3 front channels (Right, Left and Center), 2 surround channels (Rear Right and Rear Left), and a Subwoofer (LFE) Channel. Similar to Dolby Pro-Logic however any controls that only effected the subwoofer speaker would be found in a Low Frequency Enhancement Channel collection.

In both implementations of Dolby Surround and Dolby Pro-Logic the Rear channel is actually a monophonic bandwidth-limited (7 kHz) channel that is often implemented as two separate speakers, right and left. Both speakers receive the same source.

Master or system-wide controls associated with all channel positions will be found in the top-level collection of the consumer control.

Usage Name	Usage Type	Description
<b>Speaker System</b>	CL	This collection is used to define controls that effect all channels of an individual speaker system if the device contains controls for more than one speaker system.  <i>Note: that the controls defined in the top-level collection will be the true master controls, effecting all speaker systems. This collection can contain any of the following Channel collections.</i>
<b>Channel Left</b>	CL	A collection of controls associated with the Left channel.
<b>Channel Right</b>	CL	A collection of controls associated with the Right channel.
<b>Channel Center</b>	CL	A collection of controls associated with the Center channel.
<b>Channel Front</b>	CL	A collection of controls associated with the Front channels. To provide more detail on controls, this collection may optionally contain Channel Left, Channel Right, and Channel Center collections The Audio class notation for this Channel Front(Channel Left) is L. The Audio class notation for this Channel Front(Channel Right) is R. The Audio class notation for this Channel Front(Channel Center) is C.
<b>Channel Center Front</b>	CL	A collection of controls associated with the Center Front channels. To provide more detail on controls, this collection may optionally contain Channel Left and Channel Right collections The Audio class notation for this Channel Center Front(Channel Left) is LC (left of center in front). The Audio class notation for this Channel Center Front(Channel Right) is RC (right of center in front).
<b>Channel Side</b>	CL	A collection of controls associated with the Side or wall channels. To provide more detail on controls, this collection may optionally contain Channel Left and Channel Right collections The Audio class notation for this Channel Side(Channel Le <sup>2</sup>
<b>Channel Surround</b>	CL	A collection of controls associated with the Surround channels. The Audio class notation for this Channel Surround is S. To provide more detail on controls, this collection may optionally contain Channel Left and Channel Right collections The Audio class notation for this Channel Surround(Channel Left) is LS. The Audio class notation for this Channel Surround(Channel Right) is RS.
<b>Channel Low Frequency Enhancement</b>	CL	A collection of controls associated with the Low Frequency Enhancement or Subwoofer channel. The Audio class notation for this channel is LFE.
<b>Channel Top</b>	CL	A collection of controls associated with the Top or overhead channel. The Audio class notation for this channel is T.
<b>Channel Unknown</b>	CL	A collection of controls associated with an unknown channel position.

<sup>2</sup>The end of this paragraph is missing from the original document. Has be left as is.



## 15.13 PC Theatre

Usage Name	Usage Type	Description
Media Select SAP	Sel	Select Tuner using Secondary Audio Program (SAP) information.
Sub-channel	LC	Digital TV sub-channel selection control where the range of possible values is equal to the number of sub-channels supported by the device.
Sub-channel Increment	OSC	Digital TV sub-channel control where each activation of the control increments the current sub-channel selection to the next available subchannel.
Sub-channel Decrement	OSC	Digital TV sub-channel control where each activation of the control decrements the current sub-channel selection to the next available subchannel.
Alternate-audio Increment	OSC	Digital TV alternate-audio control where each activation of the control increments the current alternate-audio selection to the next available alternate-audio.
Alternate-audio Decrement	OSC	Digital TV alternate-audio control where each activation of the control decrements the current alternate-audio selection to the next available alternate-audio.

## 15.14 Programmable Buttons

Usage Name	Usage Type	Description
<b>Programmable Buttons</b>	Nary	The user defines the function of these buttons to control software applications or GUI objects. The Programmable Buttons named array contains <a href="#">Section 12 Button Page (0x09)</a> usages as selectors.

## 15.15 Application Launch Buttons

These controls launch the application that most closely relates in function to the Usage Name. When a device containing these Usages is installed, software must configure which application is associated with each control. The hardware or operating system vendor can provide configuration tools for the user to assist in or change the configuration. The following Usages are provided for this purpose:

Usage Name	Usage Type	Description
<b>Application Launch Buttons</b>	Nary	This array contains Application Launch (AL) selectors.
AL Launch Button Configuration Tool	Sel	Used to associate buttons in an array of Launch Buttons with the application to be launched.
AL Programmable Button Configuration Tool	Sel	Used to associate Buttons in an array of Programmable Buttons with the function to be performed. An example would be a key programmed to play back a series of keystrokes.
AL Consumer Control Configuration Tool	Sel	Used to associate generic controls with a specific consumer device or software player to receive the control input, regardless of user focus. For example, a set of Transport Controls could be associated with a DVD-ROM player that would receive the Mute input even when it does not have the user focus.
AL Word Processor	Sel	Launch word processor.
AL Text Editor	Sel	Launch text editor.
AL Spreadsheet	Sel	Launch spreadsheet application.
AL Graphics Editor	Sel	Launch graphics editor.
AL Presentation App	Sel	Launch presentation application.
AL Database App	Sel	Launch database application.
AL Email Reader	Sel	Launch email reader.
AL Newsreader	Sel	Launch newsreader.
AL Voicemail	Sel	Launch voicemail application.
AL Contacts/Address Book	Sel	Launch contact database manager or address book application.
AL Calendar/Schedule	Sel	Launch calendar or schedule application.
AL Task/Project Manager	Sel	Launch task or project manager application.
AL Log/Journal/Timecard	Sel	Launch log, journal or timecard application.
AL Checkbook/Finance	Sel	Launch checkbook or finance application.
AL Calculator	Sel	Launch calculator.
AL A/V Capture/Playback	Sel	Launch A/V Capture or Playback application.
AL Local Machine Browser	Sel	Launch local machine browser.
AL LAN/WAN Browser	Sel	Launch LAN/WAN browser.
AL Internet Browser	Sel	Launch internet browser.
AL Remote Networking/ISP Connect	Sel	Launch remote networking or ISP connection.

AL Network Conference	Sel	Launch network conference application.
AL Network Chat	Sel	Launch network chat application.
AL Telephony/Dialer	Sel	Launch telephony or dialer application.
AL Logon	Sel	Launch logon.
AL Logoff	Sel	Launch logoff.
AL Logon/Logoff	Sel	Launch logon or logoff depending on current state.
AL Terminal Lock/Screen saver	Sel	Launch terminal lock or screensaver.
AL Control Panel	Sel	Launch control panel.
AL Command Line Processor/Run	Sel	Launch command line processor (Run).
AL Process/Task Manager	Sel	Launch process or task manager application.
AL Select Task/Application	Sel	Launch task or application selection application.
AL Next Task/Application	Sel	Go to next task or application.
AL Previous Task/Application	Sel	Go to previous task or application.
AL Preemptive Halt Task/Application	Sel	Initiate preemptive task/application halt.
AL Integrated Help Center	Sel	Launch a system wide, context-insensitive integrated help center.
AL Power Status	Sel	Launch Power Status/Management application.
AL Documents	Sel	Launch Documents Browser application.
AL Thesaurus	Sel	Launch Thesaurus application.
AL Dictionary	Sel	Launch Dictionary application.
AL Desktop	Sel	Display Desktop (in a windowed environment).
AL Spell Check	Sel	Launch Spell Check application.
AL Grammar Check	Sel	Launch Grammar Check application.
AL Wireless Status	Sel	Launch Wireless Status/Management application.
AL Keyboard Layout	Sel	Launch Keyboard Layout Management application.
AL Virus Protection	Sel	Launch Virus Protection application.
AL Encryption	Sel	Launch Encryption Management application.
AL Screen Saver	Sel	Launch Screen Saver application.
AL Alarms	Sel	Launch Timer/Alarm application.
AL Clock	Sel	Launch System Clock application.
AL File Browser	Sel	Launch System File Browser.
AL Image Browser	Sel	Launch Image Browser.
AL Audio Browser	Sel	Launch Audio Browser.
AL Movie Browser	Sel	Launch Movie Browser.

AL Digital Rights Manager	Sel	Launch Digital Rights Manager (DRM) application. This application allows users to manage digital rights or similar credentials that they have acquired or created. The focus of the credentials cache is authentication for use of digital media.
AL Digital Wallet	Sel	Lanches the user's Digital Wallet manager. This application manages a store of credentials whose focus is online commerce.
AL Instant Messaging	Sel	Launch the user's Instant Messaging Application.
AL OEM Features/Tips/Tutorial Browser	Sel	Launch web browser with URL or app specific to PC/Web Appliance/Thin Client/ Set-top Box OEM that points out features, tips, and tutorials.
AL OEM Help	Sel	Launch help file or online help specific to a PC system, thin client or terminal. Not specific to OS or specific application.
AL Online Community	Sel	Launch web browser with URL specific to an online community.
AL Entertainment Content Browser	Sel	Launch web browser with URL specific to a site featuring music downloads, streaming video, web casts, entertainment news, and reviews.
AL Online Shopping Browser	Sel	Launch web browser with URL specific to an online store and a variety of leading product and services.
AL SmartCard Information/Help	Sel	Launch web browser with URL specific to SmartCard Information and Help
AL Market Monitor/Finance Browser	Sel	Launch web browser with URL specific to Market news or an application that allows a user to monitor market activity.
AL Customized Corporate News Browser	Sel	Launch web browser with URL specific to internal corporate news.
AL Online Activities Browser	Sel	Launch Online Activity browser. This usage would typically launch a web browser with a URL specific to a site featuring activities centered around the hardware package that included this button. i.e. a media center device would launch a web site that had activities centered around photo shooting, video shooting, camera product reviews, etc. A gaming machine would link the user to a website with gaming related reviews and news.
AL Research/Search Browser	Sel	Launch web browser with URL or app specific to doing research like an encyclopedia or thesaurus website or app,
AL Audio Player	Sel	Launches an audio player. This audio player can play one or many audio formats.
AL Message Status	Sel	Used to show status of stored voice or text messages.
AL Contact Sync	Sel	Used to initiate synchronization of device stored contact list with host system.
AL Navigation	Sel	Launch Navigation application.
AL Context-aware Desktop Assistant	Sel	Launch context-aware desktop assistant application

## 15.16 Generic GUI Application Controls

These controls provide shortcuts to software application functions or provide physical controls that mimic the controls found in a typical GUI application. Most controls in a GUI are buttons, but others such as scroll bars or zoom controls might be physically implemented as sliders or wheels.

With the exception of controls specifically assigned with a configuration tool, these controls apply their functions to the application that has the user focus. Operation when no application has the user focus, when user focus cannot be determined, or when the user focus is not unique, is undefined.

Usage Name	Usage Type	Description
<b>Generic GUI Application Controls</b>	NARY	An array that contains generic GUI Application Control (AC) selectors.
AC New	Sel	Create a new document.
AC Open	Sel	Open an existing document.
AC Close	Sel	Close the current document.
AC Exit	Sel	Exit the application.
AC Maximize	Sel	Maximize the window size.
AC Minimize	Sel	Minimize the window size or hides the window.
AC Save	Sel	Save the current document.
AC Print	Sel	Print the current document.
AC Properties	Sel	Display the properties of the current document.
AC Undo	Sel	Undo the last action.
AC Copy	Sel	Copy the selected object to a buffer.
AC Cut	Sel	Copy the selected object to a buffer and then delete the object.
AC Paste	Sel	Replace the selected object with the object in the buffer.
AC Select All	Sel	Select all objects in the current document.
AC Find	Sel	Locate an object in the current document.
AC Find and Replace	Sel	Locate an object in the current document and replace it with another object.
AC Search	Sel	Search for documents (URLs, files, web pages, etc).
AC Go To	Sel	Display a certain point in the document.
AC Home	Sel	Load the designated root of a hierarchical set of objects.
AC Back	Sel	Load the previous document.
AC Forward	Sel	Load the next document.
AC Stop	Sel	Stop loading of the current document.
AC Refresh	Sel	Reload the current document.
AC Next Link	Sel	Find and select the next hypertext link in the document.
AC Previous Link	Sel	Find and select the next hypertext link in the document.
AC Bookmarks	Sel	Display a list of stored links.
AC History	Sel	Display an ordered list of previously accessed documents.
AC Subscriptions	Sel	Display a list of subscribed content providers.
AC Zoom In	Sel	Increase the zoom factor of the document display.
AC Zoom Out	Sel	Decrease the zoom factor of the document display.
AC Zoom	LC	Set the zoom factor of the document display.
AC Full Screen View	Sel	Utilize the entire screen to display the document.

AC Normal View	Sel	Turn off Full Screen View.
AC View Toggle	Sel	Switch between Full Screen View and Normal View.
AC Scroll Up	Sel	Display a portion of the document closer to the beginning of the document.
AC Scroll Down	Sel	Display a portion of the document closer to the end of the document.
AC Scroll	LC	Set the vertical offset of the display in the document.
AC Pan Left	Sel	Display a portion of the document closer to the left margin of the document.
AC Pan Right	Sel	Display a portion of the document closer to the right margin of the document.
AC Pan	LC	Set the horizontal offset of the display in the document.
AC New Window	Sel	Create a new window containing same document.
AC Tile Horizontally	Sel	Arrange all windows one above the other with no overlapping edges.
AC Tile Vertically	Sel	Arrange all windows one beside the other with no overlapping edges.
AC Format	Sel	Apply a format to the selected object.
AC Edit	Sel	Open the selected object for editing.
AC Bold	Sel	Set the font to Bold.
AC Italics	Sel	Set the font to Italics.
AC Underline	Sel	Set the font to Underline.
AC Strikethrough	Sel	Set the font to Underline.
AC Subscript	Sel	Set the font to Underline.
AC Superscript	Sel	Set the font to Underline.
AC All Caps	Sel	Set the font to Underline.
AC Rotate	Sel	Enable rotation control.
AC Resize	Sel	Enable resize control.
AC Flip Horizontal	Sel	Flip horizontally.
AC Flip Vertical	Sel	Flip vertically.
AC Mirror Horizontal	Sel	Mirror horizontally.
AC Mirror Vertical	Sel	Mirror vertically.
AC Font Select	Sel	Enable font select control.
AC Font Color	Sel	Enable font color control.
AC Font Size	Sel	Enable font size control.
AC Justify Left	Sel	Left-justify selection.
AC Justify Center	Sel	Center-justify horizontally.
AC Justify Right	Sel	Right-justify.
AC Justify Block	Sel	Block-justify horizontally.
AC Justify Top	Sel	Left-justify.
AC Justify Center	Sel	Center-justify vertically.
AC Justify Bottom	Sel	Bottom-justify.
AC Justify Block	Sel	Block-justify vertically.
AC Indent Decrease	Sel	Decrease paragraph indent.
AC Indent Increase	Sel	Increase paragraph indent.
AC Numbered List	Sel	Convert text to a numbered list.
AC Restart Numbering	Sel	Renumber numbered text starting at 1.
AC Bulleted List	Sel	Convert text to a bulleted list.

AC Promote	Sel	Promote outline level.
AC Demote	Sel	Demote outline level.
AC Yes	Sel	Select Yes.
AC No	Sel	Select No.
AC Cancel	Sel	Select Cancel.
AC Catalog	Sel	E-commerce Go to Catalog.
AC Buy/Checkout	Sel	E-commerce Buy Order.
AC Add to Cart	Sel	E-commerce Add to Order List.
AC Expand	Sel	Expand a hierarchical List Node.
AC Expand All	Sel	Expand all hierarchical List Nodes.
AC Collapse	Sel	Collapse a hierarchical List Node.
AC Collapse All	Sel	Collapse all hierarchical List Nodes.
AC Print Preview	Sel	Preview Print Output.
AC Paste Special	Sel	Non-standard Paste.
AC Insert Mode	Sel	Toggle Insert/Overwrite edit modes.
AC Delete	Sel	Delete current object.
AC Lock	Sel	Lock display to current location in document.
AC Unlock	Sel	Unlock display from current location in document.
AC Protect	Sel	Protect selection from changes.
AC Unprotect	Sel	Unprotect selection from changes.
AC Attach Comment	Sel	Attach a comment to an object.
AC Delete Comment	Sel	Delete a comment.
AC View Comment	Sel	View a comment attached to an object.
AC Select Word	Sel	Select a word at edit point.
AC Select Sentence	Sel	Select a sentence at edit point.
AC Select Paragraph	Sel	Select a paragraph at edit point.
AC Select Column	Sel	Select a column at edit point.
AC Select Row	Sel	Select a row at edit point.
AC Select Table	Sel	Select entire table at edit point.
AC Select Object	Sel	Select object at edit point.
AC Redo/Repeat	Sel	Redo or Repeat last action.
AC Sort	Sel	Sort selection.
AC Sort Ascending	Sel	Sort in ascending order.
AC Sort Descending	Sel	Sort in descending order.
AC Filter	Sel	Filter selection.
AC Set Clock	Sel	Set system clock.
AC View Clock	Sel	View system clock.
AC Select Time Zone	Sel	Set system time zone.
AC Edit Time Zones	Sel	Edit system time zone parameters.
AC Set Alarm	Sel	Set an alarm/timer.
AC Clear Alarm	Sel	Clear an alarm/timer.
AC Snooze Alarm	Sel	Snooze an alarm timer.



AC Reset Alarm	Sel	Reset an alarm/timer.
AC Synchronize	Sel	Synchronize remote and local data.
AC Send/Receive	Sel	Send/Receive batch messages.
AC Send To	Sel	Send message to a specific recipient.
AC Reply	Sel	Reply to a message, send only to sender in FROM: list.
AC Reply All	Sel	Reply to a message, send to all recipients in TO:, FROM: and CC: fields.
AC Forward Msg	Sel	Forward a message.
AC Send	Sel	Send a message.
AC Attach File	Sel	Attach a file.
AC Upload	Sel	Upload an object.
AC Download	Sel	Download an object.
AC Set Borders	Sel	Set the graphical borders of selection.
AC Insert Row	Sel	Insert a row.
AC Insert Column	Sel	Insert a column.
AC Insert File	Sel	Insert a file.
AC Insert Picture	Sel	Insert a picture.
AC Insert Object	Sel	Insert an object.
AC Insert Symbol	Sel	Insert a symbol.
AC Save and Close	Sel	Save and close object.
AC Rename	Sel	Rename object.
AC Merge	Sel	Merge multiple objects into a single object.
AC Split	Sel	Divide a single object into multiple objects.
AC Group	Sel	Group multiple objects into a collection of objects.
AC Ungroup	Sel	Separate a collection of objects into multiple objects.
AC Distribute Horizontally	Sel	Space objects evenly along a horizontal axis.
AC Distribute Vertically	Sel	Space objects evenly along a vertical axis.
AC Next Keyboard Layout Select	Sel	Switch through set of keyboard layouts.
AC Navigation Guidance	Sel	Play/re-play the last navigation guidance prompt.
AC Desktop Show All Windows	Sel	Show all running Desktop windows.
AC Desktop Show All Applications	Sel	Show all user applications.
AC Soft Key Left	Sel	Function assigned to left soft key when display is under host control.
AC Soft Key Right	Sel	Function assigned to right soft key when display is under host control.
AC Idle Keep Alive	Sel	Sent periodically when no keys are pressed to indicate that the device is still active.

## 15.17 Contact List Controls

A device may store a list of telephone or email contacts, which consist of a record for each one which may have various fields for the name and contact information.

A contact list contains various fields of data for each contact. These are represented as Buffered Byte arrays of character data. The character data is in the same format as specified for [Section 20 Auxiliary Display Page \(0x14\)](#) and ordering is implied the same as display data as defined in [Section 20.1.4 Character Transfers ...](#)

Usage Name	Usage Type	Description
Contact Index	DV	Indicates which record in the list of contacts is being stored or retrieved, with the Logical Minimum being the first contact record on the device and Logical Maximum being the last.
Contact Edited	OOC	True if the contact record has been changed by the device since it was last stored.
Contact Added	OOC	True if the contact record has been added by the device since it was last stored.
Contact Record Active	OOC	If true the contact record is active, if false the record is not currently in use.
Contact Status Flag	DV	Buffered Byte array of the status for each contact using the status OOC usages defined above.
Contact Nickname	DV	Nickname displayed for the contact.
Contact First Name	DV	Contact's given name.
Contact Last Name	DV	Contact's surname.
Contact Full Name	DV	Contact's full name including first and last names.
Contact Phone Number Personal	DV	Contact's personal phone number.
Contact Phone Number Business	DV	Contact's office phone number.
Contact Phone Number Mobile	DV	Contact's mobile phone number.
Contact Phone Number Pager	DV	Contact's paging device number.
Contact Phone Number Fax	DV	Contact's facsimile number.
Contact Phone Number Other	DV	Contact's uncategorized phone number.
Contact Email Personal	DV	Contact's personal email address.
Contact Email Business	DV	Contact's business email address.
Contact Email Other	DV	Contact's uncategorized email address.
Contact Email ID	DV	Contact's primary email address.
Contact Speed Dial Number	DV	The speed dial shortcut key sequence assigned to this contact.
Contact Misc	DV	unformatted binary data associated with this contact record.

## 15.18 Descriptive Controls

The below describes descriptive controls that are usable in a Feature Report to describe capabilities of a keyboard collection. The controls may be constant or variable, depending on whether the keyboard is a fixed (e.g. wired) implementation, or are reported from a wireless adapter that supports possibly dynamically-changing physical keyboards.

The Feature Report should be described in a keyboard Top-Level Application Collection, and the Input Report should be described in a Consumer Top-Level Application Collection, in the same or similar field that reports other hotkeys such as Mute or Volume controls.

Usage Name	Usage Type	Description
<b>Extended Keyboard Attributes Collection</b>	CL	Declares a Logical Collection containing extended attributes for a keyboard. The descriptive controls must be enclosed within a Logical Collection tagged with this usage, within a Generic Desktop(Keyboard) Top-Level Application Collection.
Keyboard Form Factor	SV	<ul style="list-style-type: none"> <li>• 0: Unknown Form Factor.</li> <li>• 1: Full-Size keyboard.</li> <li>• 2: Compact keyboard. Such keyboards are less than 13" wide.</li> </ul>
Keyboard Key Type	SV	<ul style="list-style-type: none"> <li>• 0: Unknown Key Type.</li> <li>• 1: Full-travel keys.</li> <li>• 2: Low-travel keys such as those on laptop keyboards.</li> <li>• 3: Zero-travel or virtual keys.</li> </ul>
Keyboard Physical Layout	SV	<p>The usage does not refer to the legend set printed on the keys, but only to the physical keyset layout, defined by the relative location and shape of the textual keys in relation to each other. This usage indicates which of the de facto standard physical layouts to which the keyboard conforms. These layouts are commonly understood.</p> <ul style="list-style-type: none"> <li>• 0: Unknown Layout.</li> <li>• 1: 101 (e.g. US)</li> <li>• 2: 103 (Korea)</li> <li>• 3: 102 (e.g. German)</li> <li>• 4: 104 (e.g. ABNT Brazil)</li> <li>• 5: 106 (DOS/V Japan)</li> <li>• 6: Vendor-specific - If specified, 'Vendor-Specific Keyboard Physical Layout' must also be specified.</li> </ul>
Vendor-Specific Keyboard Physical Layout	SV	A numeric identifier of the particular Vendor-specific Keyboard Physical Layout. Values for this field are defined by the hardware vendor but 0x00 is defined to not specify a Vendor-specific Keyboard Physical Layout. If non-zero, 'Keyboard Physical Layout' must have value 0x06. If this identifier is 0x00, 'Keyboard Physical Layout' must not have the value 0x06. If 'Keyboard Physical Layout' is omitted, 'Vendor-Specific Keyboard Physical Layout' must also be omitted.

Keyboard IETF Language Tag Index	SV	<p>String index of a String Descriptor having an IETF Language Tag. This Language Tag specifies the intended primary locale of the keyboard legend set, conformant to IETF BCP 47<sup>3</sup> or its successor. Operating systems may use this information to help select a layout that maps keyboard usages to textual glyphs.</p> <p>This specification does not specify the exact glyph sets, as small variances may apply in particular implementations. If an appropriate IETF Language Tag is not available, such as for custom, adaptive or new layouts, the control should be omitted or set to 0x00.</p>
Implemented Keyboard Input Assist Controls	SV	<p>Bitmap for physically implemented controls. The input report field for Keyboard Input Assist controls may be declared as an array using Usage Min and Usage Max tags, but the keyboard is not required to implement every control in that range. However, host software may need to know which controls are actually implemented in order to present an appropriate user interface.</p> <ul style="list-style-type: none"> <li>• All 0: No Keyboard Input Assist controls are implemented.</li> <li>• Bit 0: Previous Suggestion</li> <li>• Bit 1: Next Suggestion</li> <li>• Bit 2: Previous Suggestion Group</li> <li>• Bit 3: Next Suggestion Group</li> <li>• Bit 4: Accept Suggestion</li> <li>• Bit 5: Cancel Suggestion</li> </ul> <p><i>All other bits reserved.</i></p>

<sup>3</sup><https://tools.ietf.org/html/bcp47>

## 15.19 Input Assist Selectors

The below describes usages for controls allowing users to offer specialized input for navigating and selecting from lists of proposed insertions, as is currently done in common Input Method Editors. The controls are not limited to text insertions, but could be used by HID Host software to select and insert any type of object into the current editing context.

Keyboard Input Assist is any system that presents a list of potential elements to be inserted in the current input stream. Types of elements could be graphical substitutions, word suggestions or script translations such as Rōmaji-to-Kanji in Japanese or Hangeul-to-Hanja in Korean. User interfaces may only present a subset of all possible candidate elements, and a provision is made to page through groups of candidates with the Group navigation controls below.

Usage Name	Usage Type	Description
Keyboard Input Assist Previous	Sel	Selects the previous Keyboard Assist element, if any.
Keyboard Input Assist Next	Sel	Selects the next Keyboard Input Assist element, if any.
Keyboard Input Assist Previous Group	Sel	Highlights the previous Keyboard Input Assist element group, if any.
Keyboard Input Assist Next Group	Sel	Highlights the previous Keyboard Input Assist element group, if any.
Keyboard Input Assist Accept	Sel	Commits the selected Keyboard Input Assist element.
Keyboard Input Assist Cancel	Sel	Cancels Keyboard Input Assist for the current input element boundary.

## 15.20 Game Recording Controls

Usage Name	Usage Type	Description
Invoke Capture Interface	Sel	Invokes or dismisses the user interface that allows users to invoke game capture and broadcasting features.
Start or Stop Game Recording	Sel	Toggles video capture of the game currently being played.
Historical Game Capture	Sel	Takes a recording of the last X amount of gameplay.
Capture Game Screenshot	Sel	Takes a screenshot of the game currently being played.
Show or Hide Recording Indicator	Sel	Toggle the visibility of User Interface elements that indicate that recording is happening.
Start or Stop Microphone Capture	Sel	Toggle the inclusion of microphone input in game recordings and broadcasting.
Start or Stop Camera Capture	Sel	Toggle the inclusion of webcam capture in game recordings and broadcasting.
Start or Stop Game Broadcast	Sel	Start or stop broadcasting your gameplay to broadcast providers.

## 15.21 Access Controls

Provides system access controls to devices (i.e. similar to that commonly via System Settings) being programmatically accessed by applications.

Usage Name	Usage Type	Description
Camera Access Enabled	OOC	Enables programmatic access to camera devices.
Camera Access Disabled	OOC	Disables programmatic access to camera devices.
Camera Access Toggle	OOC	Toggles the current state of the camera access control.

## 15.22 Keyboard Backlight Controls

Exposing keyboard backlight controls to the system (rather than exclusively controlled internally by the device), allows for more seamless integration with Hosts. Additionally, permits assistive technology (e.g. screen readers) during the device learning mode, such that when a key is pressed in this mode, the assistive technology will tell the user what key was pressed and what it does. This allows visually impaired users to learn the keys of their device.

Usage Name	Usage Type	Description
Keyboard Brightness Increment	OSC	Brightens the keyboard backlight by one unit, if possible.
Keyboard Brightness Decrement	OSC	Dims the keyboard backlight by one unit, if possible.
Keyboard Backlight Set Level	LC	Sets the keyboard backlight brightness directly with a value.
Keyboard Backlight OOC	OOC	Turns the keyboard backlight on or off.
Keyboard Backlight Set Minimum	OSC	Dims the keyboard backlight to minimum non-off level.
Keyboard Backlight Set Maximum	OSC	Brightens the keyboard backlight to its brightest level.
Keyboard Backlight Auto	OOC	Permits the keyboard to use its own brightness algorithms.



## 15.23 Privacy Screen Controls

Some displays have an electronic privacy screen which can be activated to prevent others from seeing data on the user's screen, by limiting or obscuring the light that is emitted at an angle far from perpendicular to the screen.

It may be desirable to adjust the privacy level to account for ambient lighting, so the user can achieve their desired screen visibility while maintaining an acceptable level of privacy.

Control for privacy screens may be performed by a dedicated device, or embedded in another device, such as a keyboard.

Usage Name	Usage Type	Description
Privacy Screen Toggle	OOC	Toggles state of privacy screen.
Privacy Screen Level Decrement	RTC	Decrease level of privacy screen.
Privacy Screen Level Increment	RTC	Increase level of privacy screen.
Privacy Screen Level Minimum	OSC	Engage lowest level of privacy screen.
Privacy Screen Level Maximum	OSC	Engage highest level of privacy screen.

# 16 Digitizers Page (0x0D)

This section provides detailed descriptions of the usages employed by Digitizer Devices.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Digitizer</b>	CA	<a href="#">16.1</a>
02	<b>Pen</b>	CA	<a href="#">16.1</a>
03	<b>Light Pen</b>	CA	<a href="#">16.1</a>
04	<b>Touch Screen</b>	CA	<a href="#">16.1</a>
05	<b>Touch Pad</b>	CA	<a href="#">16.1</a>
06	<b>Whiteboard</b>	CA	<a href="#">16.1</a>
07	<b>Coordinate Measuring Machine</b>	CA	<a href="#">16.1</a>
08	<b>3D Digitizer</b>	CA	<a href="#">16.1</a>
09	<b>Stereo Plotter</b>	CA	<a href="#">16.1</a>
0A	<b>Articulated Arm</b>	CA	<a href="#">16.1</a>
0B	<b>Armature</b>	CA	<a href="#">16.1</a>
0C	<b>Multiple Point Digitizer</b>	CA	<a href="#">16.1</a>
0D	<b>Free Space Wand</b>	CA	<a href="#">16.1</a>
0E	<b>Device Configuration</b> <a href="#">[7]</a>	CA	<a href="#">16.7</a>
0F	<b>Capacitive Heat Map Digitizer</b> <a href="#">[54]</a>	CA	<a href="#">16.9</a>
10-1F	<i>Reserved</i>		
20	<b>Stylus</b> <a href="#">[55]</a>	CA/CL	<a href="#">16.2</a>
21	<b>Puck</b>	CL	<a href="#">16.2</a>
22	<b>Finger</b>	CL	<a href="#">16.2</a>
23	<b>Device settings</b> <a href="#">[7]</a>	CL	<a href="#">16.7</a>
24	<b>Character Gesture</b> <a href="#">[45]</a>	CL	<a href="#">16.8</a>
25-2F	<i>Reserved</i>		
30	Tip Pressure	DV	<a href="#">16.3.1</a>
31	Barrel Pressure	DV	<a href="#">16.3.1</a>
32	In Range	MC	<a href="#">16.3.1</a>
33	Touch	MC	<a href="#">16.3.1</a>
34	Untouch	OSC	<a href="#">16.3.1</a>
35	Tap	OSC	<a href="#">16.3.1</a>
36	Quality	DV	<a href="#">16.3.1</a>
37	Data Valid	MC	<a href="#">16.3.1</a>
38	Transducer Index	DV	<a href="#">16.3.1</a>
39	<b>Tablet Function Keys</b>	CL	<a href="#">16.3.1</a>
3A	<b>Program Change Keys</b>	CL	<a href="#">16.3.1</a>
3B	Battery Strength	DV	<a href="#">16.3.1</a>
3C	Invert	MC	<a href="#">16.3.1</a>
3D	X Tilt	DV	<a href="#">16.3.2</a>
3E	Y Tilt	DV	<a href="#">16.3.2</a>
3F	Azimuth	DV	<a href="#">16.3.3</a>

40	Altitude	DV	16.3.3
41	Twist	DV	16.3.3
42	Tip Switch	MC	16.4
43	Secondary Tip Switch	MC	16.4
44	Barrel Switch	MC	16.4
45	Eraser	MC	16.4
46	Tablet Pick	MC	16.4
47	Touch Valid [3]	MC	16.5
48	Width [3]	DV	16.5
49	Height [3]	DV	16.5
4A-50	<i>Reserved</i>		
51	Contact Identifier [7]	DV	16.6
52	Device Mode [7]	DV	16.7
53	Device Identifier [7]	DV/SV	16.7
54	Contact Count [7]	DV	16.6
55	Contact Count Maximum [7]	SV	16.6
56	Scan Time [51]	DV	16.5
57	Surface Switch [51]	DF	16.5
58	Button Switch [51]	DF	16.5
59	Pad Type [51]	SF	16.5
5A	Secondary Barrel Switch [18]	MC	16.4
5B	Transducer Serial Number [18]	SV	16.3.1
5C	Preferred Color [25]	DV	16.3.1
5D	Preferred Color is Locked [31]	MC	16.3.1
5E	Preferred Line Width [31]	DV	16.3.1
5F	Preferred Line Width is Locked [31]	MC	16.3.1
60	Latency Mode [51]	DF	16.5
61	Gesture Character Quality [45]	DV	16.8
62	Character Gesture Data Length [45]	DV	16.8
63	Character Gesture Data [45]	DV	16.8
64	<b>Gesture Character Encoding</b> [45]	NAry	16.8
65	UTF8 Character Gesture Encoding [45]	Sel	16.8
66	UTF16 Little Endian Character Gesture Encoding [45]	Sel	16.8
67	UTF16 Big Endian Character Gesture Encoding [45]	Sel	16.8
68	UTF32 Little Endian Character Gesture Encoding [45]	Sel	16.8
69	UTF32 Big Endian Character Gesture Encoding [45]	Sel	16.8
6A	Capacitive Heat Map Protocol Vendor ID [54]	SV	16.9
6B	Capacitive Heat Map Protocol Version [54]	SV	16.9
6C	Capacitive Heat Map Frame Data [54]	DV	16.9
6D	Gesture Character Enable [63]	DF	16.8

6E-6F	<i>Reserved</i>		
70	<b>Preferred Line Style [31]</b>	NARY	16.3.1
71	Preferred Line Style is Locked [31]	MC	16.3.1
72	Ink [31]	Sel	16.3.1
73	Pencil [31]	Sel	16.3.1
74	Highlighter [31]	Sel	16.3.1
75	Chisel Marker [31]	Sel	16.3.1
76	Brush [31]	Sel	16.3.1
77	No Preference [31]	Sel	16.3.1
78-7F	<i>Reserved</i>		
80	<b>Digitizer Diagnostic [31]</b>	CL	16.7
81	<b>Digitizer Error [31]</b>	NARY	16.7
82	Err Normal Status [31]	Sel	16.7
83	Err Transducers Exceeded [31]	Sel	16.7
84	Err Full Trans Features Unavailable [31]	Sel	16.7
85	Err Charge Low [31]	Sel	16.7
86-8F	<i>Reserved</i>		
90	<b>Transducer Software Info [36]</b>	CL	16.3.1
91	Transducer Vendor Id [36]	SV	16.3.1
92	Transducer Product Id [36]	SV	16.3.1
93	<b>Device Supported Protocols [36]</b>	NARY/CL	16.3.1
94	<b>Transducer Supported Protocols [36]</b>	NARY/CL	16.3.1
95	No Protocol [36]	Sel	16.3.1
96	Wacom AES Protocol [36]	Sel	16.3.1
97	USI Protocol [36]	Sel	16.3.1
98	Microsoft Pen Protocol [55]	Sel	16.3.1
99-9F	<i>Reserved</i>		
A0	<b>Supported Report Rates [36]</b>	SV/CL	16.3.1
A1	Report Rate [36]	DV	16.3.1
A2	Transducer Connected [36]	SF	16.3.1
A3	Switch Disabled [36]	Sel	16.3.1
A4	Switch Unimplemented [36]	Sel	16.3.1
A5	Transducer Switches [36]	Sel	16.3.1
A6-FFFF	<i>Reserved</i>		

Table 16.1: Digitizer Page

## 16.1 Digitizer Devices

Usage Name	Usage Type	Description
<b>Digitizer</b>	CA	A device that measures absolute spatial position, typically in two or more dimensions. This is a generic usage; several specialized types of digitizers are distinguished by their attributes.
<b>Pen</b>	CA	A digitizer with an integrated display that allows use of a stylus. The system must ensure that the sensed stylus position and the display representations of that position are the same. A pen digitizer has enough time and space resolution for handwriting input. A digitizer that may or may not be in an integrated display application should use the more generic Digitizer collection usage.
<b>Light Pen</b>	CA	A display-integrated digitizer that relies on the underlying video raster to determine position. The interpretation of light pen coordinates is sensitive to changes of display mode.
<b>Touch Screen</b>	CA	A digitizer with an integrated display that allows the use of a finger or stylus for pointing. Some touch-screen technologies can differentiate between the touch of a finger and the touch of a stylus.
<b>White Board</b>	CA	A digitizer that is mounted vertically and can optionally be synchronized with a projected video display.
<b>Coordinate Measuring Machine</b>	CA	A specialized digitizing instrument that is used to make spatial measurements of maps or photographic images. It is not suitable for screen pointing.
<b>3D Digitizer</b>	CA	General usage for a digitizer that measures position(s) in three dimensional space.
<b>Stereo Plotter</b>	CA	A 3D digitizer that relies on the operator's binocular vision to determine the position of points on a stereoscopically rendered image.
<b>Articulated Arm</b>	CA	A 3D digitizer that uses a series of instrumented mechanical linkages to determine the position of its tip in space.
<b>Armature</b>	CA	A 3D digitizer that determines the position of several mechanical linkages in space. An armature typically represents the position of a human body for animation or modeling.
<b>Multiple Point Digitizer</b>	CA	A 3D digitizer that detects the position of multiple points in space, typically through some non-mechanical means such as electromagnetic sensors.
<b>Free Space Wand</b>	CA	A 3D digitizer that detects the position of a point at the end of a handheld wand.
<b>Capacitive Heat Map Digitizer</b>	CA	A digitizer that collects raw capacitive data in a heat map format and reports to the host device for additional processing.

## 16.2 Digitizer Transducer Collections

Usage Name	Usage Type	Description
<b>Stylus</b>	CA/CL	A stylus is a hand-held transducer that looks and is used like a pen. A digitizer typically reports the coordinates of the tip of a stylus. A stylus may report additional data independently of the digitizer. The <b>Stylus</b> collection is a physical collection containing all the controls physically located on the stylus. In the <b>Stylus</b> collection a <b>Pointer</b> physical collection will contain the axes reported by the stylus.
<b>Puck</b>	CL	A puck, sometimes called a cursor, is a mouse-like transducer that rests on a low friction surface. A digitizer typically reports the coordinates of crosshairs marked on the puck. The <b>Puck</b> collection is a logical collection containing all the controls located on the puck. In the <b>Puck</b> collection a <b>Pointer</b> physical collection will contain the axes reported by the puck.
<b>Finger</b>	CL	Any human appendage used as a transducer, such as a finger touching a touch screen to set the location of the screen cursor. A digitizer typically reports the coordinates of center of the finger. In the <b>Finger</b> collection a <b>Pointer</b> physical collection will contain the axes reported by the finger.

## 16.3 Digitizer Report Fields

Not all digitizer field usages are from the Digitizer usage page. In particular, the usages for X and Y displacement come from the Generic Desktop page.

### 16.3.1 Digitizer-Specific Fields

Usage Name	Usage Type	Description
Tip Pressure	DV	Force exerted against the tablet surface by the transducer, typically a stylus.
Barrel Pressure	DV	Force exerted directly by the user on a transducer sensor, such as a pressure-sensitive button on the barrel of a stylus.
In Range	MC	Indicates that a transducer is located within the region where digitizing is possible. In Range is a bit quantity.
Touch	MC	A bit quantity for touch pads analogous to In Range that indicates that a finger is touching the pad. A system will typically map a Touch usage to a primary button.
Untouch	OSC	Indicates the release of a finger from the surface of the touch screen. A system typically maps an Untouch usage to the release of a primary button.
Tap	OSC	On a touch pad, indicates that the finger has been quickly lifted and replaced on the tablet surface. This is typically mapped to a button event, but is distinct as no physical button is involved.
Quality	DV	If set, indicates that the transducer is sensed to be in a relatively noise-free region of digitizing.
Data Valid	MC	Indicates that the current data set is valid.
Transducer Index	DV	Indicates which transducer generated the current report. Transducer Index is useful if multiple transducers generate identical reports. Otherwise, report IDs should be used to distinguish different transducer types.
<b>Tablet Function Keys</b>	CL	These controls are located on the surface of a digitizing tablet, and may be implemented as actual switches, or as soft keys actuated by the digitizing transducer. These are often used to trigger location-independent macros or other events.
<b>Program Change Keys</b>	CL	Specialized function key targets that change some internal aspect of the digitizer's behavior.
Battery Strength	DV	Indicates the amount of power remaining in a digitizer component that is outside the scope of device power management. Typically this is the battery for a cordless transducer.
Invert	MC	A bit that indicates that the currently sensed position originates from the end of a stylus opposite the tip.
Transducer Serial Number	SV	A unique persistent identifier provided by the transducer currently in use.
Preferred Color	DV	An indication of what color ink the transducer would prefer to render. This may be an indication of the body color (for a set of virtual crayons) or might be an indication of a switch selection (for example tail switches to choose color in a fashion similar to multi-color inking pens). If the transducer allows writing to the usage it may store a color for later retrieval. Only two data sizes are allowed, 8 bits and 24 bits. An eight-bit value specifies a color index based on the W3C named colors <sup>1</sup> <sup>2</sup> with the elimination of the grey/gray duplicates. The color name to index mapping is presented in Appendix A <a href="#">Indices for 8bit Preferred Colors</a> . A value of 0xFF indicates no preferred color. A 24-bit value specifies three 8 bits values for RGB color in that order. It is not possible to indicate no preferred color when using 24 bit values.

<sup>1</sup><http://www.w3.org/TR/SVG/types.html>

<sup>2</sup><http://www.w3.org/TR/css3-color/>

Preferred Color is Locked	MC	This is an indication that the preferred color cannot be changed. This may be because the body color or tail switch selection is expected to be honored, or that the transducer does not allow or is incapable of changing the preferred color.
Preferred Line Width	DV	An indication of what line width the transducer would prefer to render. This may be an indication of the physical width of the tip of a stylus. If the transducer allows writing to the usage it may store a width for later retrieval. The descriptor for this usage is expected to include logical and physical minimums and maximums. The recommended physical resolution is 0.1 mm. A zero line width indicates minimum possible width (such as one pixel width at any zoom factor).
Preferred Line Width is Locked	MC	This is an indication that the preferred line width cannot be changed. This may be because the line width indicates a physical tip size and is expected to be enforced, or that the transducer does not allow or is incapable of changing the preferred line width.
<b>Preferred Line Style</b>	NArY	An indication of what line style the transducer would prefer to render. This may be an indication of the physical characteristics of the stylus. If the transducer allows writing to the usage it may store a line style for later retrieval.
Preferred Line Style is Locked	MC	This is an indication that the preferred line style cannot be changed. This may be because the transducer has physical ink or pencil and style is expected to be enforced, or that the transducer does not allow or is incapable of changing the preferred line style.
Ink	Sel	This type indicates an inking pen, such as ballpoint, roller ball, gel, or fountain. This is usually the default style for note taking.
Pencil	Sel	This type indicates a graphite pencil style.
Highlighter	Sel	This type indicates a flat (not chisel) tip highlighter style.
Chisel Marker	Sel	This type indicates a chisel tip marker style.
Brush	Sel	This type indicates a round brush style.
No preference	Sel	This indicates a lack of preference or a generic style.
<b>Transducer Software Info</b>	CL	A collection of usages that is useful for software update purposes. For example this may contain vendor ID, product ID, and software version information.
Transducer Vendor Id	SV	A vendor identification from a list of vendors. This may or may not be a vendor ID assigned by USB-IF.
Transducer Product Id	SV	A vendor defined product Id.
<b>Device Supported Protocols</b>	NArY/CL	This is an array of the protocols that the digitizer device supports. This could also be used as a collection of protocol/protocol version pairs to indicate not only the protocols supported but also one or more versions of the protocol.
<b>Transducer Supported Protocols</b>	NArY/CL	This is an array of the protocols that the transducer supports. This could also be used as a collection of protocol/protocol version pairs to indicate not only the protocols supported but also one or more versions of the protocol.
No Protocol	Sel	No supported protocol. This can be used to fill empty array elements.
Wacom AES Protocol	Sel	Indicates the transducer supports the Wacom Active Electrostatic Stylus protocol.
USI Protocol	Sel	Indicates the transducer supports the Universal Stylus Initiative protocol.
Microsoft Pen Protocol	Sel	Indicates the transducer supports the Microsoft Pen protocol.
<b>Supported Report Rates</b>	SV/CL	Reports per second supported by the digitizer. This may be a single value or may act as a collection of supported rates.



Report Rate	DV	The current number of reports sent per second. If there is a single value for Supported Report Rates the rate is assumed to be fixed. If there is more than one value for Supported Report Rates the rate is assumed to be changeable to any of the rates in the Supported Report Rates collection.
Transducer Connected	SF	The transducer is actively connected. This is an indication that commands and queries supported by the transducer can be issued.
Switch Disabled	Sel	Used to indicate that one of the switches has been disabled.
Switch Unimplemented	Sel	Used to indicate a switch does not exist (such as a stylus with no secondary barrel button).
<b>Transducer Switches</b>	CL	Used as a container for switches on a transducer.

### 16.3.2 Tilt Orientation

X Tilt and Y Tilt are used together to specify the tilt away from normal of a digitizer transducer. In its normal position, the values of X Tilt and Y Tilt for a transducer are both zero. The X Tilt/Y Tilt orientation of a system does not specify the rotation of the transducer around its own normal axis.

Usage Name	Usage Type	Description
X Tilt	DV	This quantity is used in conjunction with Y Tilt to represent the tilt away from normal of a transducer, such as a stylus. The X Tilt value represents the plane angle between the Y-Z plane and the plane containing the transducer axis and the Y axis. A positive X Tilt is to the right.
Y Tilt	DV	This value represents the angle between the X-Z and transducer-X planes. A positive Y Tilt is toward the user.

### 16.3.3 Azimuth-Altitude Orientation

Azimuth-altitude is an alternative to the tilt system of specifying a digitizer transducer's orientation. This system includes rotation of the transducer around its own axis.

Usage Name	Usage Type	Description
Azimuth	DV	Specifies the counter-clockwise rotation of the cursor around the Z axis through a full circular range.
Altitude	DV	Specifies the angle with the X-Y plane through a signed, semicircular range. Positive values specify an angle downward and toward the positive Z axis.
Twist	DV	Specifies the clockwise rotation of the cursor around its own major axis.

## 16.4 Digitizer Switch Usages

Usage Name	Usage Type	Description
Tip Switch	MC	A switch located at the tip of a stylus, indicating contact of the stylus with a surface. A pen-based system or system extension would use this switch to enable the input of handwriting or gesture data. The system typically maps Tip Switch to a primary button in a non-pen context.
Secondary Tip Switch	MC	A secondary switch used in conjunction with Tip Switch to indicate pressure above a certain threshold applied with the stylus. The threshold switch is not closed unless the tip switch already is.
Barrel Switch	MC	A non-tip button located on the barrel of a stylus. Its function is typically mapped to a system secondary button or to a Shift key modifier that changes the Tip Switch function from primary button to secondary button.
Eraser	MC	This control is used for erasing objects. Following the metaphor of a pencil, it is typically located opposite the writing end of a stylus. It may be a bit switch or a pressure quantity.
Tablet Pick	MC	The primary button used by CAD systems, typically to select an object. Sometimes called Button Zero.
Secondary Barrel Switch	MC	A second non-tip button located on the barrel of a stylus further from the tip than the Barrel Switch. Its function is typically mapped to a system secondary or tertiary button.

## 16.5 Touch Digitizer Usages

These are to be used by devices that support additional information about touch contacts, such as the height and width of the contact, or combination pen/touch devices that report additional information to assist with accidental touch rejection (palm rejection).

Usage Name	Usage Type	Description
Touch Valid	MC	Indicates the device's confidence that the touch contact was an intended, valid contact. The device should report 0 if the contact is not a valid touch. The device should report 1 if the contact is intended and valid (e.g. a <i>pointing</i> touch).
Width	DV	The width of a touch contact. Height and width of contact are assumed to be centered about the reported x and y values. Units are assumed to match x's units.
Height	DV	The height of a touch contact. Height and width of contact are assumed to be centered about the reported x and y values. Units are assumed to match y's units.
Scan Time	DV	For each frame reported, the digitizer shall report a timestamp in relative time. The units are in 100 microseconds by default. The first scan time received is treated as a base time for subsequent reported times. This value represents the time difference from the first frame that was reported after a device starts reporting data subsequent to a period of inactivity. The time differences between reported scan times should reflect the scanning frequency of the digitizer. The scan time value should be the same for all contacts within a frame.
Surface Switch	DF	To allow for better power management, a host may wish to indicate what it would like a touchpad digitizer to not report surface digitizer contacts by clearing this flag. By default, upon cold-boot/power cycle, touchpads that support reporting surface contacts shall do so by default.
Button Switch	DF	To allow for better power management, a host may wish to indicate what it would like a touchpad digitizer to not report button state changes by clearing this flag. By default, upon cold-boot/power cycle, touchpads that support reporting button state shall do so by default.
Pad Type	SF	A touchpad digitizer may be physically depressible (often referred to as a click-pad) or it may not (often referred to as a pressure-pad). This usage allows the device to identify its pad type to the host. When set, the touchpad is non-depressible (pressure-pad); when clear, the touchpad is depressible (click-pad).
Latency Mode	DF	The host may indicate to the input device when high latency is desirable for power savings by setting this flag and normal latency mode when clear. By default, upon cold-boot/power cycle, digitizers shall report with normal latency.

## 16.6 Multi-touch Digitizer Usages

For devices that support reporting multiple simultaneous contacts.

Usage Name	Usage Type	Description
Contact Identifier	DV	An identifier associated with a contact. The id persists for the duration of that contact's detection, but may be reused for another contact once the original is no longer detected. Detection is assumed to extend from contact down to contact up notifications (or for devices that support hover detection, contact in-range to out-of-range).
Contact Count	DV	The current number of contacts the digitizer detects and is reporting.
Contact Count Maximum	SV	Used to report the maximum number of concurrent contacts a digitizer is capable of detecting.

## 16.7 Device Configuration Usages

Usage Name	Usage Type	Description
<b>Device Configuration</b>	CA	CA for the top-level collection housing a configuration feature report. A device configuration feature report is used to support changing the digitizer's behavior dynamically.
Device Mode	DV	The current input mode configuration for a device. 0 represents reporting as a mouse, 1 represents single input device (e.g. a HID single touch or pen device), and 2 represents multi-input device (e.g. HID touch device supporting contact identifier and contact count maximum). For example, having a mouse collection and specifying mouse mode allows broad down-level device support across hosts.
Device Identifier	DV/SV	<p>This is a static value (SV) when it is part of a digitizer or mouse top-level collection. It is required when there are multiple digitizer top-level collections of the same kind in a report descriptor. This usage uniquely identifies the digitizer top-level collection and should appear in a feature report. If the device can function as a mouse, the mouse collection should have the same device identifier as the corresponding digitizer collection. Devices with only one digitizer top-level collection do not need to have a device identifier usage.</p> <p>When the usage is part of a device settings logical collection, it is a dynamic value (DV). It allows the host to select the device it wants to configure. A value of 0 indicates all collections. A non-zero value indicates the top-level collection with matching device identifier.</p>
<b>Device Settings</b>	CL	The logical collection containing the device configuration usages (Device identifier and device mode).
<b>Digitizer Diagnostic</b>	CL	This is a collection used for diagnostic purposes. This usage allows diagnostic feature reports to be discovered by usage instead of a report ID.
<b>Digitizer Status</b>	NArY	This is a collection of the status codes that the digitizer supports. The status codes are reported in a single location array.
Err Normal Status	Sel	This status indicates the digitizer is operating normally.
Err Transducers Exceeded	Sel	This error will occur if the number of transducers in range of a digitizer exceeds the number of simultaneously supported transducers.
Err Full Trans Features Unavailable	Sel	This error will occur if all of the features of a transducer cannot be supported. This could happen, for example, if the available bandwidth between a transducer and digitizer is insufficient to transport all available data. In this situation the digitizer may fall back to only transporting the highest priority data.
Err Charge Low	Sel	This error occurs when the transducer's battery or super-cap charge is low and the user needs to recharge their transducer.

## 16.8 Character Gesture Usages

*Basic character gesture recognition* allows an accessory to convey a single character string as a result of interpreting transducer movement on a digitizer surface. For the host to properly detect support for these gestures, the accessory must declare a logical collection with the following usages:

- Character Gesture
- Character Gesture Data Length
- Character Gesture Data
- Gesture character enable

Additionally, the device must also include string encoding information. If more than one encoding type is supported, they must be placed in a selector array. Otherwise, the accessory may declare individual encoding support via a static item. Using the following usages:

- Character Gesture Encoding
- UTF8 Character Gesture Encoding
- UTF16 Little Endian Character Gesture Encoding
- UTF16 Big Endian Character Gesture Encoding
- UTF32 Little Endian Character Gesture Encoding
- UTF32 Big Endian Character Gesture Encoding

If the recognition system generates more than one interpretation of a gesture motion, alternate interpretations can be conveyed from a single device. This allows the host to select the appropriate string based on its current application context.

Each gesture item follows the requirements detailed in *Basic character gesture recognition*, but must also include a declaration for `Character Gesture Quality` in each logical collection. This gives the host additional qualitative information so it can select the appropriate interpretation. Additionally, if no alternatives are available, the recognition system must inform the host by ensuring that only the first character is populated and all subsequent characters are cleared.

Usage Name	Usage Type	Description
<b>Character Gesture</b>	CL	Character gesture controls. Multiple interpretations of a character gesture must be declared as multiple logical collections
Gesture Character Quality	DV	If there are multiple interpretations available, this usage conveys the confidence of a particular interpretation.
Character Gesture Data Length	DV	Length of character data
Character Gesture Data	DV	Character data. If there is no valid interpretation to be reported this value must be cleared to zero.
<b>Gesture Character Encoding</b>	NArY	An array that identifies the character encoding used
UTF8 Character Gesture Encoding	Sel	UTF8 Character Gesture Encoding
UTF16 Little Endian Character Gesture Encoding	Sel	UTF16 Little Endian Character Gesture Encoding
UTF16 Big Endian Character Gesture Encoding	Sel	UTF16 Big Endian Character Gesture Encoding
UTF32 Little Endian Character Gesture Encoding	Sel	UTF32 Little Endian Character Gesture Encoding
UTF32 Big Endian Character Gesture Encoding	Sel	UTF32 Big Endian Character Gesture Encoding
Gesture Character Enable	DF	Enable or disable gesture character recognition

## 16.9 Heat Map Usages

Having advanced touch processing offloaded from firmware to a host device, can allow for additional context to be provided for object classification, from the state of the device (grounding to devices, position of displays) to the user's intent (foreground app, location of UI elements on screen, etc).

Typically, this data is commonly represented as a heat map - a matrix of raw capacitive measurements representing the sensed capacitance at sensor locations across the screen. Currently, there are multiple formats for the encoding of raw capacitive data which differ from vendor to vendor. These encodings allow for heat map data to be sent into multiple reports for reporting of large sensor areas, reporting a subset of the heat map for power savings, and packaging additional data relevant for input processing.

Usage Name	Usage Type	Description
Capacitive Heat Map Protocol Vendor ID	SV	Specifies the vendor of the heat map protocol, for interpreting the data associated with an input of Capacitive Heat Map Frame Data, and associated additional input usages which are necessary for the protocol. This would be a USB-IF Vendor ID.
Capacitive Heat Map Protocol Version	SV	Specifies the heat map encoding protocol version, if applicable, to differentiate between multiple protocols developed by a single vendor.
Capacitive Heat Map Frame Data	DV	Represents a heat map frame from a digitizer. The format of the raw data inside this frame is dependent on the protocol vendor specified in the Capacitive Heat Map Protocol Vendor ID usage.

# 17 Haptics Page (0x0E)

The [Physical Input Device](#) framework defines a protocol for rich control of force-feedback devices, typically joysticks or *rumble packs*. However, for many devices, only simple feedback is needed for common feedback such as clicks, buzzes and such that are non-directional, and should be consistent from device to device and vendor to vendor, albeit tuned to the specific hardware.

The below specifics a simplified haptics feedback control, with most features being optional, from simple, autonomous click feedback to somewhat more complex models with host-controlled variable intensity and timing. The protocol uses discoverable, pre-defined user-level haptic events.

These haptics controls can be stand-alone, such as a phone vibration unit, or associated with a particular control or set of controls, such as a rigid-surface keyboard. As such, they may be contained within an independent Haptic Controller Application.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Simple Haptic Controller</b>	CA/CL	<a href="#">17.1</a>
02-0F	<i>Reserved</i>		
10	<b>Waveform List</b>	NAry	<a href="#">17.1</a>
11	<b>Duration List</b>	NAry	<a href="#">17.1</a>
12-1F	<i>Reserved</i>		
20	Auto Trigger	DV	<a href="#">17.1</a>
21	Manual Trigger	DV	<a href="#">17.1</a>
22	Auto Trigger Associated Control	SV	<a href="#">17.1</a>
23	Intensity	DV	<a href="#">17.1</a>
24	Repeat Count	DV	<a href="#">17.1</a>
25	Retrigger Period	DV	<a href="#">17.1</a>
26	Waveform Vendor Page	SV	<a href="#">17.1</a>
27	Waveform Vendor ID	SV	<a href="#">17.1</a>
28	Waveform Cutoff Time	SV	<a href="#">17.1</a>
29-1000	<i>Reserved</i>		
1001	Waveform None	SV	<a href="#">17.1</a>
1002	Waveform Stop	SV	<a href="#">17.1</a>
1003	Waveform Click	SV	<a href="#">17.1</a>
1004	Waveform Buzz Continuous	SV	<a href="#">17.1</a>
1005	Waveform Rumble Continuous	SV	<a href="#">17.1</a>
1006	Waveform Press	SV	<a href="#">17.1</a>
1007	Waveform Release	SV	<a href="#">17.1</a>
1008-2000	<i>Reserved</i>		
2001-2FFF	<i>Reserved for Vendor Waveforms</i>		
3000-FFFF	<i>Reserved</i>		

Table 17.1: Haptics Page



## 17.1 Simple Haptic Controller

Usage Name	Usage Type	Description
<b>Simple Haptic Controller</b>	CA/CL	Applied to a collection containing a Haptic Transducer Set to control simple haptics events. The CA is for Haptic Transducer Sets with no association with other HID controls. The CL form is used when contained within another CA.
<b>Waveform List</b>	NArY	Collection containing Ordinals that contain the Usages of supported waveforms. Vendor specific waveform IDs may also be used. See the Haptics Usage Page table for the enumeration of pre-defined Waveform selector usages that can be placed in the set. The Waveform List is mandatory, there is no default defined.  Standard waveform usage names are generic and are not intended to specify the particular properties of a waveform. It is assumed that the device manufacturer will design and incorporate waveforms appropriate to the resonance, dampening and other properties of the mechanical system with a best effort to provide the intended effect.
<b>Duration List</b>	NArY	Collection of Ordinals containing the default duration for each haptic waveform. Default units are milliseconds.
Auto Trigger	DV	<b>Feature.</b> Ordinal in the Waveform List to trigger autonomously. Default is undefined. If 0, autonomous triggering is disabled.
Manual Trigger	DV	<b>Output.</b> Ordinal in the Waveform List to trigger immediately. May be accompanied by Intensity, Repeat Count and/or Retrigger Period outputs to override feature variants of those controls.
Auto Trigger Associated Control	SV	<b>Feature.</b> Contains the 32-bit Extended Usage of a HID Input or Logical Collection containing at least one HID Input. The Auto Trigger waveform is autonomously triggered when a HID Input in the Auto Trigger Associated Control changes.
Intensity	DV	<b>Feature or Output.</b> Percentage of maximum intensity to apply to the waveform. If declared as a feature, applies to all waveforms. If declared as an output, applies to the Waveform ordinal specified by a Manual Trigger in the same output report. Default is unspecified. NULL values are ignored.
Repeat Count	DV	<b>Feature or Output.</b> Count of retriggered waveform firings per trigger. Default is zero. NULL values are ignored.
Retrigger Period	DV	<b>Feature or Output.</b> Period before a retrigger occurs. Default units are milliseconds. Setting to 0 uses the Duration in the Duration List. Default is zero. NULL values are ignored.
Waveform Vendor Page	SV	Read-only <b>Feature.</b> Vendor Page in which the vendor-specific waveform usages are defined. No default. If vendor-specific waveforms are declared, Waveform Vendor Page is required. Writes to Waveform Vendor Page shall be ignored.
Waveform Vendor ID	SV	Read-only <b>Feature.</b> Vendor ID of the vendor whom the Waveform Vendor Page is defined. Default is the USB Device Vendor ID. Writes to Waveform Vendor ID shall be ignored.
Waveform Cutoff Time	DV	<b>Feature.</b> Maximum time for a continuous waveform or set of retriggered waveforms before being automatically cut off. If any continuous waveform is declared (Duration = 0), Waveform Cutoff time is required. Default units are seconds. No default.
Waveform None	SV	
WaveForm Stop	SV	
Waveform Click	SV	
Waveform Buzz Continuous	SV	

Waveform Rumble Continuous	SV	
Waveform Press	SV	
Waveform Release	SV	

## 17.2 Simple Haptic Controller Operation

A Simple Haptic Controller is declared by declaring an Application Collection or Logical Collection with the Simple Haptic Controller usage.

### 17.2.1 Lists

For the purposes of Simple Haptic Controllers, a List is a Logical Collection containing non-zero Ordinals. Lists are declared by naming a Logical Collection with a Named Array usage, and then defining a set of Ordinal Page inputs, outputs or features within that collection. A member of the List is referred to in this document as an Ordinal, and the Ordinal contains a value type appropriate for array. As such, Lists may contain Selectors, On-Off Controls, Dynamic Values or other appropriate Usage Types. If a List is specified herein as read-only, then all Ordinals in the List are unchanged if written. If any Ordinal receives a NULL value, the Ordinal is unchanged.

*Note: Ordinal 0 is Reserved on the Ordinals page and shall not be declared.*

The purpose of a List is to create an ordered array of elements. While the HID Specification indicates that collections may contain any number of elements, the order of presentation of the elements is not specified. By using unique Ordinals, the position of elements within a collection of controls is deterministic.

### 17.2.2 Waveforms

Simple Haptic Controllers shall expose the waveforms that can be triggered, and their durations. This is accomplished with a Waveform List and a Duration List.

Simple Haptic Controllers shall declare a Waveform List feature with at least one Waveform other than the implicit required Waveform None and Waveform Stop waveforms (see below). The Waveform List is read-only. Each Ordinal in the Waveform List contains the 16-bit Usage value of a valid waveform from the Haptics Page. Any Ordinal containing a Usage value that is unknown to the Host should not be triggered by the Host.

#### 17.2.2.1 Required Waveforms

All Simple Haptic Controllers shall support Waveform None in Ordinal 1 and Waveform Stop in Ordinal 2 of the Waveform List. Waveform None is ignored by the Simple Haptic Controller and is provided as a means to permit writing other values in a report without changing the waveform. Waveform None also permits gaps in the Waveform List. Waveform Stop cancels any triggered waveform immediately. A Waveform List may contain additional Waveform None or Waveform Stop Ordinals in any other Ordinal aside from Ordinal 1 and Ordinal 2. The implicit Ordinal 1 and Ordinal 2 are not declared in the Waveform List.

#### 17.2.2.2 Vendor Waveforms

A range is provided for vendor-specific waveform usages. If these are declared, a Waveform Vendor Page shall also be declared within the Waveform List. To enable use of third-party haptic libraries, a third-party Waveform Vendor ID may also be declared within the Waveform List to override the device Vendor ID. Irrespective of the optional Vendor ID or Vendor Page declared, the vendor waveform usages themselves shall be within the Vendor Waveform range shown in the Haptic Usage Page. Hosts shall correlate the Waveform Vendor Page and device Vendor ID or third-party Waveform Vendor ID, if provided, to known waveform tables before triggering any vendor-specific waveform. Behavior of vendor-specific waveforms other than Duration is unspecified.

### 17.2.3 Duration of Waveforms

Simple Haptic Controllers shall declare a Duration List feature with the same Ordinals declared in the Waveform List. The Duration List is read-only. The Duration Ordinals contain the duration of each waveform declared in the corresponding Ordinal in the Waveform List. The default units are milliseconds but other units may be applied. The Default Duration of Ordinal 1 and Ordinal 2 are implicitly zero and are not declared.

### 17.2.3.1 Continuous Waveforms

A zero Duration indicates a **Continuous Waveform**. A continuous waveform triggered with a Manual Trigger shall be stopped by triggering any waveform other than Waveform None, and Waveform Stop is recommended before triggering any other waveform. A Continuous Waveform triggered by an Auto Trigger stops after cessation of input activity. The hold time to detect cessation of input activity is not defined but should be short enough to correlate with the cessation of change but long enough to endure continuously during typical continuous user input.

If a Continuous Waveform is declared, a Waveform Cutoff time shall also be declared to ensure that the waveform does eventually cease.

### 17.2.4 Triggers

At least one trigger mechanism shall exist. This can be a Manual Trigger output control or an Auto Trigger feature control, or an Implicit Waveform.

The Auto Trigger and Manual Trigger contain Waveform Ordinals to play. Both are optional. Setting the Manual Trigger immediately triggers the selected Waveform Ordinal. Setting the Auto Trigger selects the waveform to be triggered with autonomous triggering. Setting Manual Trigger or Auto Trigger to Ordinal 1 (Waveform None) has no effect. If the Auto Trigger is set to Ordinal 2 (Waveform Stop), then Auto Mode is disabled. If the Manual Trigger is declared and the Auto Trigger is not declared, then the device does not support autonomous triggering. If neither a Manual Trigger nor an Auto Trigger is declared, then the lowest declared Waveform Ordinal is the default Implicit Waveform and is autonomously triggered as if it were selected in a declared Auto Trigger. In this case, Haptic events can only be disabled by declaring and setting Intensity to 0. Manual Trigger is an output and Auto Trigger have no default values – it is up to the device manufacturer to determine if Auto Trigger has a Waveform Stop or other waveform by default. If the host needs to know the Auto Trigger value at any time, it may read the control.

Triggers defined	Behavior
None	Autonomous Trigger of Implicit Waveform (use Intensity to enable/disable)
Manual	Selectable-waveform Manual Trigger only
Auto	Selectable-waveform Autonomous Trigger only
Manual and Auto	Selectable-waveform Manual and Auto Triggers

Table 17.3: Trigger Behavior by Definition

Ordinal 0 is reserved on the Ordinals page and shall not be declared, is a NULL value, and shall be ignored if issued to either Manual Trigger or Auto Trigger.

#### 17.2.4.1 Auto Mode Trigger Association

Simple Haptic Controllers that support autonomous triggering may need a means to associate the Simple Haptic Controller with one or more other HID input controls in the Application Collection. There are three scenarios supported:

- **No Association:** In this scenario, the Simple Haptic Control is placed in a Simple Haptic Controller Application Collection. The control or events that trigger autonomous haptic events is not associated with any HID control.
- **Limited input trigger:** In this scenario, a read-only Auto Trigger Associated Control feature is declared. The Auto Trigger Associated Control contains a unique Extended Usage of a HID input control or collection (with HID inputs) within the Application Collection but outside the Simple Haptic Controller collection. If identical controls exist, wrap the associated control in a Logical Collection with a unique usage and indicate that usage. Any input change in the control or collection will trigger the Auto Mode or Implicit Waveform.
- **Global input trigger:** In this scenario, the Auto Trigger Associated Control feature is not declared. Any HID input in the Application Collection will trigger the Auto Trigger or Implicit Waveform.

### 17.2.4.2 Retriggering

A Simple Haptic Controller may declare a Repeat Count feature and/or output control. The Repeat Count indicates the number of times to trigger any selected Waveform Ordinal per Auto Trigger or Manual Trigger. Default Repeat Count is zero. Writing a NULL Repeat Count has no effect. A repeat trigger is called a retrigger. Continuous retrigger is not supported.

By default, the retrigger occurs at the end of the waveform. To modify the pacing of the retrigger in a Repeat Count, a Retrigger Period feature and/or output may be declared. If declared, the Retrigger Period defines the time between retriggers. If the Repeat Count is zero, Retrigger Period is ignored. Writing a NULL Retrigger Period has no effect. Writing a zero Retrigger Period value resets the retrigger to the corresponding value in the Duration List so that the waveform immediately retriggers when it completes. Default Retrigger Period is zero. Default units of Retrigger Period is milliseconds, but other units may be applied.

If a Repeat Count or Retrigger Period feature is declared, it supplies the default value for all triggered waveforms. If a Manual Trigger output is accompanied by a Repeat Count or Retrigger Period output in the same report, the accompanying value overrides the default value for that single Manual Trigger. Behavior when they are not in the same output report is undefined. Repeat Count and Retrigger Period are valid for continuous waveforms.

Issuing Ordinal 0 (Waveform None) to a Manual Trigger or Auto Trigger will have no effect. Any waveform can be immediately canceled by writing Ordinal 1 (Waveform Stop) to a Manual Trigger. If Ordinal 1 is written to the Auto Trigger, the waveform will be stopped at the next autonomous trigger. If a waveform is triggered, either via receipt of a Manual Trigger, an autonomous trigger or retrigger before the prior waveform has completed, it shall stop the prior waveform and start the new waveform.

### 17.2.4.3 Intensity

A Simple Haptic Controller may declare an Intensity feature and/or output control. The Intensity indicates the relative intensity of the haptic waveform as a percentage of the designed full strength capability of the transducer(s). Default Intensity is unspecified. Writing a NULL Intensity has no effect. If Intensity is set to zero, then the haptic transducer is disabled.

If an Intensity feature is declared, it supplies the default value for all triggered waveforms. If a Manual Trigger is accompanied by an Intensity output in the same report, the accompanying value overrides the default value. It is recommended that if an Intensity output is declared that an Intensity feature also be declared so that the Host can read the default value. Behavior when Intensity and Manual Trigger are not in the same output report is undefined.

*Note: For the most consistent experience, hardware designers are encouraged to linearize Intensity according to perceived intensity, not according to power or amplitude.*

# 18 Unicode Page (0x10)

The Unicode Page directly maps to the two-octet form defined in the Unicode Standard.

The Unicode Standard, Version 1.1, is the newest version of the Unicode™ Standard. Unicode 1.1 includes the changes and additions that were made to Unicode 1.0 in the process of alignment with the international character encoding standard, ISO/IEC 10646-1, which was approved by ISO/IEC as an International Standard in June 1992, and published in May 1993. The character content and encoding of Unicode 1.1 is thus identical to that of the ISO/IEC 10646-1 UCS-2 (the two-octet form).

# 19 Eye and Head Trackers Page (0x12)

An eye tracker is a device designed to measure gaze point and eye position. When calibrated against a display device, an eye tracker is capable of returning coordinates on the screen the user is looking at. Using these coordinates it is possible to define mechanisms to interact with applications using eyes.

A head tracker performs a similar role, except it tracks the orientation of the head against the calibrated screen and returns the corresponding coordinate. An eye tracker may be capable of tracking both head and eyes.

This page has facilities to discover, control and read data from eye trackers and head trackers mounted on the monitor (also referred to as remote trackers).

*Note: To protect end-user privacy, the usages in this page should only be used for interactive use cases. This means that a host that implements this interface must not transfer gaze point data to any other device, nor store gaze point data for later transfer to any other device. This applies both to raw gaze point data, as well as any aggregate of this.*

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Eye Tracker</b>	CA	<a href="#">19.1</a>
02	<b>Head Tracker</b>	CA	<a href="#">19.1</a>
03-0F	<i>Reserved</i>		
10	<b>Tracking Data</b>	CP	<a href="#">19.3</a>
11	<b>Capabilities</b>	CL	<a href="#">19.2</a>
12	<b>Configuration</b>	CL	<a href="#">19.5</a>
13	<b>Status</b>	CL	<a href="#">19.6</a>
14	<b>Control</b>	CL	<a href="#">19.7</a>
15-1F	<i>Reserved</i>		
20	Sensor Timestamp	DV	<a href="#">19.1</a>
21	Position X	DV	<a href="#">19.1</a>
22	Position Y	DV	<a href="#">19.1</a>
23	Position Z	DV	<a href="#">19.1</a>
24	<b>Gaze Point</b>	CP	<a href="#">19.1</a>
25	<b>Left Eye Position</b>	CP	<a href="#">19.1</a>
26	<b>Right Eye Position</b>	CP	<a href="#">19.1</a>
27	<b>Head Position</b>	CP	<a href="#">19.1</a>
28	<b>Head Direction Point</b>	CP	<a href="#">19.1</a>
29	Rotation about X axis	DV	<a href="#">19.1</a>
2A	Rotation about Y axis	DV	<a href="#">19.1</a>
2B	Rotation about Z axis	DV	<a href="#">19.1</a>
2C-FF	<i>Reserved</i>		
100	Tracker Quality	SV	<a href="#">19.2</a>
101	Minimum Tracking Distance	SV	<a href="#">19.3</a>
102	Optimum Tracking Distance	SV	<a href="#">19.3</a>
103	Maximum Tracking Distance	SV	<a href="#">19.3</a>
104	Maximum Screen Plane Width	SV	<a href="#">19.4</a>
105	Maximum Screen Plane Height	SV	<a href="#">19.4</a>
106-1FF	<i>Reserved</i>		

200	Display Manufacturer ID	SV	<a href="#">19.5</a>
201	Display Product ID	SV	<a href="#">19.5</a>
202	Display Serial Number	SV	<a href="#">19.5</a>
203	Display Manufacturer Date	SV	<a href="#">19.5</a>
204	Calibrated Screen Width	SV	<a href="#">19.5</a>
205	Calibrated Screen Height	SV	<a href="#">19.5</a>
206-2FF	<i>Reserved</i>		
300	Sampling Frequency	DV	<a href="#">19.6</a>
301	Configuration Status	DV	<a href="#">19.6</a>
302-3FF	<i>Reserved</i>		
400	Device Mode Request	DV	<a href="#">19.7</a>
401-FFFF	<i>Reserved</i>		

Table 19.1: Eye and Head Trackers Page



## 19.1 Eye/Head Trackers

The origin of the coordinate system sits in the top left corner of the screen, x values increases in the right direction, y values increases downwards, and z values increases when moving outwards from the display facing the user.

Usage Name	Usage Type	Description
<b>Eye Tracker</b>	CA	Reports eye position and eye gaze point.  <i>Default units are in micrometers for distances, and radians with five decimals for rotations.</i>
<b>Head Tracker</b>	CA	Reports the head direction point and head position.  <i>Default units are in micrometers for distances, and radians with five decimals for rotations.</i>
Sensor Timestamp	DV	Sensor timestamp of the applicable physical collection.  <i>Sensor timestamp is a 64-bit integer. Since HID does not support 64-bit values natively and supports only signed 32-bit integers, this field is represented as an 8-byte blob. Default units are microseconds.</i>
Position X	DV	X coordinate of the applicable physical collection.
Position Y	DV	Y coordinate of the applicable physical collection.
Position Z	DV	Z coordinate of the applicable physical collection.
<b>Gaze Point</b>	CP	The location on the display the user is looking at. Contains the [X, Y] coordinates on the screen where the user is gazing.
<b>Left Eye Position</b>	CP	The center of eyeball position of the left eye in 3D space relative to the defined eye position origin. Contains the [X, Y, Z] coordinates of the left eye with respect to the screen.
<b>Right Eye Position</b>	CP	The center of eye ball position of the right eye in 3D space relative to the defined eye position origin. Contains the [X, Y, Z] coordinates of the right eye with respect to the screen.
<b>Head Position</b>	CP	The position and rotation of the head relative to the defined head position origin. Contains the [X, Y, Z] coordinates of the head with respect to the screen.  The [X, Y, Z] coordinates of the head is the mid point on a straight line between the users eyes. The head position collection also includes the orientation of the head, thus extending the physical collection with [Rx, Ry, Rz] in extrinsic Euler angles, applied in Rx, Ry, Rz order.
<b>Head Direction Point</b>	CP	The location on the display the user is pointing his face to. Contains the [X, Y] coordinates on the screen where the vector, originating from the [X, Y, Z] Head Position coordinates while being orthogonal to the users face, intersects with the screen.
Rotation about X axis	DV	Rotation about the X axis of the applicable physical collection.
Rotation about Y axis	DV	Rotation about the Y axis of the applicable physical collection.
Rotation about Z axis	DV	Rotation about the Z axis of the applicable physical collection.

## 19.2 Capabilities Collection

Usage Name	Usage Type	Description
Capabilities	CL	This collection contains the capabilities of the sensor.
Tracker Quality	SV	<p>This field provides guidance regarding the quality of the tracker. It is an enumeration whose values are described below.</p> <p><i>An eye tracker needs to report a quality level to be usable, and head tracker does not require a specific quality level and should set the quality level to N/A.</i></p> <ul style="list-style-type: none"> <li>• 0 : N/A</li> <li>• 1 : Fine Gaze</li> </ul>

**Fine gaze:** At least 95% of the Population has an Average Accuracy of  $<2^\circ$ . Average Accuracy is defined as the average Accuracy over a Screen under Normal Conditions. If more than two of the twelve measurement points are non valid, the average accuracy is defined to be *Infinity*.

**Population** is defined as a user group of at least 600 participants, distribution as follows:

- Ages: 10–60, uniformly distributed.
- Gender: uniformly distributed.
- Eye color: light and dark, at least 40% of each category.
- Makeup: yes/no. At least 25% in each category.
- Sight correction: None, glasses (at least 20%), lenses (at least 5%).
- Glasses: Shall be uniformly distributed across nearsighted/farsighted. Diopters uniformly distributed at least up to +/-5.

**Normal Conditions** are defined as: Measured at 200–500 lux, user calibrated close to center of tracked volume, and where testing is done at a user position moved 10 cm from the calibrated position in a randomized direction (in X Y Z).

**Screen.** The screen is divided in a 4 by 3 grid, with one measurement point randomized in each of the 12 areas. Screen dimensions must be the largest screen size supported by the tracker at the specified quality level. The screen background color during calibration must be grey and during testing it must be black or white, selected randomly for each participant (at least 40% of each).

**Accuracy** is defined as offset between (1) measurement point and (2) average of all collected gaze data over 1000ms. It must be at least one collected gaze data for the measurement point to be considered valid.

## 19.3 Tracking Distance

These fields with define the working distance of the eye or head tracker.

Default units are in micrometers.

Usage Name	Usage Type	Description
<b>Tracking Data</b>	CP	
Minimum Tracking Distance	SV	A read-only field specifying the least distance from the sensor that the sensor can accurately track the user.
Optimum Tracking Distance	SV	A read-only field specifying the distance at which the sensor gives the most accurate tracking data.
Maximum Tracking Distance	SV	A read-only field specifying the maximum distance, beyond which the sensor cannot track the user.

## 19.4 Maximum Screen Plane

These values specify the surface area within which the tracker can perform accurate tracking. These values may define a surface larger than that of the current calibrated screen, thus indicating that the tracker can recognize gaze coordinates outside of the monitor. The tracker may also return data for gaze point outside this range. But the values outside of this range are likely to be less accurate.

Default units are in micrometers.

Usage Name	Usage Type	Description
Maximum Screen Plane Width	SV	A read-only field specifying the width of the largest surface that can be tracked at the optimal distance from the sensor.
Maximum Screen Plane Height	SV	A read-only field specifying the height of the largest surface that can be tracked at the optimal distance from the sensor.

## 19.5 Configuration Collection

First four usages in this collection correspond to the layout of the Display Product Identification of the EDID<sup>1</sup>. The next two usages contain the width and height of the calibrated display.

The monitor information identifies the calibrated display in case of multimonitor scenarios. The width and height are used to scale the returned tracking data coordinates to logical pixels for application consumption. The data in this collection needs to be re-queried whenever the configuration status changes.

Usage Name	Usage Type	Description
<b>Configuration</b>	CL	Returns the EDID Information of the calibrated monitor.
Display Manufacturer ID	SV	The manufacturer ID of the calibrated display. This is two bytes in size. It is the manufacturer's 3-letter EISA PNP ID, currently managed and assigned by UEFI.org. The encoding of the three-letter ID is the same as in the EDID header version 1.3.
Display Product ID	SV	This is a two-byte value that contains the Product ID code of the calibrated display.
Display Serial Number	SV	A four-byte value that has the serial number of the display.
Display Manufacturer Date	SV	A two-byte value that contains the manufacturer assigned date for the display. The lower order byte contains the week of manufacture, and the higher order byte contains the year of manufacture, less 1990 for years from 1990-2245. If week=255, it is the model year instead.
Calibrated Screen Width	SV	Width of the calibrated display in physical units. Default units are micrometers.
Calibrated Screen Height	SV	Height of the calibrated display in physical units. Default units are micrometers.

<sup>1</sup>VESA Enhanced EDID Standard (PDF), Video Electronics Standards Association, 2000-02-09, p. 32, retrieved 2011-11-19

## 19.6 Status Collection

Usage Name	Usage Type	Description
Status	CL	Contains the current status of the device.  <i>When the configuration status changes, the device should send an input report notifying the OS.</i>
Sampling Frequency	DV	An integer that specifies the current sampling frequency of the sensor. Default units are Hz.
Configuration Status	DV	An enumeration specifying the configuration status of the device. <ul style="list-style-type: none"><li>• 1 : <b>Ready</b> - The device is configured and ready for use.</li><li>• 2 : <b>Configuring</b> - The device is undergoing configuration.</li><li>• 3 : <b>Screen Setup Needed</b> - Screen plane setup has not been performed on the device.</li><li>• 4 : <b>User Calibration Needed</b> - The user needs to perform a calibration to make the device usable.</li></ul>

## 19.7 Control Collection

Usage Name	Usage Type	Description
<b>Control</b>	CL	Contains ways to control the device. The allowed operations are to activate or inactivate disable gaze point, eye position or head position measurements.
Device Mode Request	DV	This is an enumeration specifying the requested mode for the tracker. <ul style="list-style-type: none"><li>• 1 : <b>Enable Gaze Point</b> - Request device to provide gaze point data.</li><li>• 2 : <b>Enable Eye Position</b> - Request device to provide eye position data.</li><li>• 4 : <b>Enable Head Position</b> - Request device to provide head position data.</li></ul>

## 20 Auxiliary Display Page (0x14)

The Auxiliary Display page is intended for use by simple alphanumeric/auxiliary displays that are used on consumer devices. Making the alphanumeric and bitmap specific types of segments on an Auxiliary Display and creating a Custom Segments Report (CL) allow display manufacturers to produce displays with different segments. (e.g. custom segment as a battery indicator on a mobile phone)

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Alphanumeric Display</b>	CA	<a href="#">20.1</a>
02	<b>Auxiliary Display [2]</b>	CA	<a href="#">20.2</a>
03-1F	<i>Reserved</i>		
20	<b>Display Attributes Report</b>	CL	<a href="#">20.1.1</a>
21	ASCII Character Set	SF	<a href="#">20.1.1</a>
22	Data Read Back	SF	<a href="#">20.1.1</a>
23	Font Read Back	SF	<a href="#">20.1.1</a>
24	<b>Display Control Report</b>	CL	<a href="#">20.1.2</a>
25	Clear Display	DF	<a href="#">20.1.2</a>
26	Display Enable	DF	<a href="#">20.1.2</a>
27	Screen Saver Delay	SV/DV	<a href="#">20.1.2</a>
28	Screen Saver Enable	DF	<a href="#">20.1.2</a>
29	Vertical Scroll	SF/DF	<a href="#">20.1.3</a>
2A	Horizontal Scroll	SF/DF	<a href="#">20.1.3</a>
2B	<b>Character Report</b>	CL	<a href="#">20.1.4</a>
2C	Display Data	DV	<a href="#">20.1.4</a>
2D	<b>Display Status</b>	CL	<a href="#">20.1.5</a>
2E	Stat Not Ready	Sel	<a href="#">20.1.5</a>
2F	Stat Ready	Sel	<a href="#">20.1.5</a>
30	Err Not a loadable character	Sel	<a href="#">20.1.5</a>
31	Err Font data cannot be read	Sel	<a href="#">20.1.5</a>
32	Cursor Position Report	Sel	<a href="#">20.1.6</a>
33	Row	DV	<a href="#">20.1.6</a>
34	Column	DV	<a href="#">20.1.6</a>
35	Rows	SV	<a href="#">20.1.6</a>
36	Columns	SV	<a href="#">20.1.6</a>
37	Cursor Pixel Positioning	SF	<a href="#">20.1.6</a>
38	Cursor Mode	DF	<a href="#">20.1.6</a>
39	Cursor Enable	DF	<a href="#">20.1.6</a>
3A	Cursor Blink	DF	<a href="#">20.1.6</a>
3B	<b>Font Report</b>	CL	<a href="#">20.1.7</a>
3C	Font Data	Buffered Bytes	<a href="#">20.1.7</a>
3D	Character Width	SV	<a href="#">20.1.7</a>
3E	Character Height	SV	<a href="#">20.1.7</a>
3F	Character Spacing Horizontal	SV	<a href="#">20.1.7</a>



40	Character Spacing Vertical	SV	20.1.7
41	Unicode Character Set	SF	20.1.1
42	Font 7-Segment	SF	20.1.1
43	7-Segment Direct Map	SF	20.1.1
44	Font 14-Segment	SF	20.1.1
45	14-Segment Direct Map	SF	20.1.1
46	Display Brightness	DV	20.1.2
47	Display Contrast	DV	20.1.2
48	<b>Character Attribute</b>	CL	20.1.1
49	Attribute Readback	SF	20.1.1
4A	Attribute Data	DV	20.1.4
4B	Char Attr Enhance	OOC	20.1.1
4C	Char Attr Underline	OOC	20.1.1
4D	Char Attr Blink	OOC	20.1.1
4E-7F	<i>Reserved</i>		
80	Bitmap Size X [2]	SV	20.2.1
81	Bitmap Size Y [2]	SV	20.2.1
82	Max Blit Size [2]	SV	20.2.4
83	Bit Depth Format [2]	SV	20.2
84	Display Orientation [2]	DV	20.2.2
85	<b>Palette Report</b> [2]	CL	20.2.3
86	Palette Data Size [2]	SV	20.2.3
87	Palette Data Offset [2]	SV	20.2.3
88	Palette Data [2]	Buffered Bytes	20.2.3
89-89	<i>Reserved</i>		
8A	<b>Blit Report</b> [2]	CL	20.2.4
8B	Blit Rectangle X1 [2]	SV	20.2.4
8C	Blit Rectangle Y1 [2]	SV	20.2.4
8D	Blit Rectangle X2 [2]	SV	20.2.4
8E	Blit Rectangle Y2 [2]	SV	20.2.4
8F	Blit Data [2]	Buffered Bytes	20.2.4
90	<b>Soft Button</b> [2]	CL	20.2.1.5
91	Soft Button ID [2]	SV	20.2.1.5
92	Soft Button Side [2]	SV	20.2.1.5
93	Soft Button Offset 1 [2]	SV	20.2.1.5
94	Soft Button Offset 2 [2]	SV	20.2.1.5
95	Soft Button Report [2]	SV	20.2.5
96-C1	<i>Reserved</i>		
C2	Soft Keys [5]	SV	20.1.1
C3-CB	<i>Reserved</i>		
CC	Display Data Extensions [5]	SF	20.1.1

CD-CE	<i>Reserved</i>		
CF	Character Mapping [5]	SV	<a href="#">20.3</a>
D0-DC	<i>Reserved</i>		
DD	Unicode Equivalent [5]	SV	<a href="#">20.3</a>
DE-DE	<i>Reserved</i>		
DF	Character Page Mapping [5]	SV	<a href="#">20.3</a>
E0-FE	<i>Reserved</i>		
FF	Request Report [5]	DV	<a href="#">20.4</a>
100-FFFF	<i>Reserved</i>		

Table 20.1: Auxiliary Display Page

## 20.1 Alphanumeric Display

Usage Name	Usage Type	Description
Alphanumeric Display	CA	A collection of alphanumeric-related display usages.

### 20.1.1 Flags

If a flag is defined as a single-bit constant **Input** item, it is simply a read-only bit for the host. If a flag is defined as an **Output** item, it can be used to enable or disable the flag's feature.

The Display ASCII Character Set defines a minimum character set that will be supported by a display. The blank character locations in the table may be optionally defined by a vendor. All characters will be passed to the display, so to take advantage of the other characters the controlling application must know vendor-specific information. The total number of character codes supported is vendor-specific.

Usage Name	Usage Type	Description
Display Attributes Report	CL	Identifies the report associated with features of the display device.
ASCII Character Set	SF	Finding this usage in a display application descriptor indicates that the device supports an 8-bit ASCII-compatible character set as shown in Table 20.4. In the table, the high nibble of the character code is labeled across the top and the low nibble is labeled down the left side. NoOp means that no operation is performed if this character is received. Space clears the character position.
Unicode Character Set	SF	Finding this usage in a display application descriptor indicates that the device displays the Unicode character set. If defined, it implies that 16-bit characters will be transferred in the Display Data field and the Buffered Bytes flag is set.
Data Read Back	SF	Finding this usage in a display application descriptor indicates that the <b>Character Report</b> can be read back. Otherwise, the display data is writeonly.
Font Read Back	SF	Finding this usage in a display application descriptor indicates that the <b>Font Report</b> can be read back. Otherwise, the display font is write-only.
Font 7-Segment	SF	Finding this usage in a display definition indicates that the characters are constructed using 7 segments. Displays that use 7-segment characters are limited to 127 characters. Where, setting the most significant bit of any character will turn on the decimal point (DP) of the respective character position.
7-Segment Direct Map	SF	Finding this usage in a display application descriptor indicates that the 7-segment displays of the device support a direct bit-to-segment mapping (vs. ASCII mapping). i.e. bits in data bytes sent to the display enable individual character segments and are not encoded as ASCII characters. See Table 20.5 for the bit-to-segment mapping.
Font 14-Segment	SF	Finding this usage in a display definition indicates that the characters are constructed using 14 segments. Displays that use 14-segment characters are limited to 127 characters. Where, setting the most significant bit of any character will turn on the decimal point (DP) of the respective character.

14-Segment Direct Map	SF	Finding this usage in a display application descriptor indicates that the 14-segment displays of the device support a direct bit-to-segment mapping (vs. ASCII mapping). i.e. bits in data sent to the display enable individual character segments and are not encoded as ASCII characters. Each character will take 2 bytes. See Table 20.6 for the bit-to-segment mapping.
<b>Character Attribute</b>	CL	The fields defined in this collection, form a template which is used by Attribute Data reports to access the attributes associated with a character. The fields defined in this collection are treated as static by system software. i.e. Modifying the fields defined by this collection will not effect the characters of the display, a Data Attribute must be used to do this. This collection will contain one or more of the following Char Attr usages.
Char Attr Enhance	OOC	If 1, Enhance character, else display character normally. i.e. for a monochrome display, reverse all pixels in a character. Black pixels become white, white pixels become black. If 0, pixels in a character are displayed with their default.
Char Attr Underline	OOC	If 1, Underline character, else no underline.
Char Attr Blink	OOC	If 1, Blink character, else no blink.
Attribute Readback	SF	Finding this usage in a display definition indicates that a Character Report containing Attribute Data usages can be read back. Otherwise, the display attributes are write-only.
Soft Keys	SV	Indicates the number of keys which have software displayable labels are present on the device.
Display Data Extensions	SF	Finding this usage in the display attributes report indicates that the extensions to the display data report as defined below 20.7 are supported by the device.

Low Nibble	High Nibble							
	0	1	2	3	4	5	6	7
0	NoOp		Space	0	@	P	'	p
1			!	1	A	Q	a	q
2			"	2	B	R	b	r
3			#	3	C	S	c	s
4			\$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			'	7	G	W	g	w
8			(	8	H	X	h	x
9			)	9	I	Y	i	y
A			*	:	J	Z	j	z
B			+	;	K	[	k	{
C			,	<	L	\	l	
D			-	=	M	]	m	}
E			.	>	N	^	n	
F			/	?	O	_	o	

Table 20.4: ASCII Display Character Set

Bit							
0	1	2	3	4	5	6	7
A	B	C	D	E	F	G	DP

Table 20.5: 7-Segment Direct Mapping Data

Byte	Bit							
	0	1	2	3	4	5	6	7
0	A	B	C	D	E	F	G	H
1	I	J	K	L	M	N	Unused	DP

Table 20.6: 14-Segment Direct Mapping Data

Code	Description
0x0006	Un-escape character. The character code following this character is treated as display data regardless of its value. For example in a one-byte per character display to include display data with the value 0x1B which is normally treated as an escape, sending the sequence 0x06 0x1B would result in the display data byte 0x1B being written in that display position.
0x0007	Set cursor position, the following byte specifies a new cursor position with the upper 4 bits being the row and the lower 4 bits being the column.

0x0008	Set cursor position long, the following two bytes specifies a new cursor position. The first following byte has 7 bits specifying the row, and the most significant bit of the byte is a flag which if set indicates the cursor is to be set to blink. The blinking of the cursor will continue until the cursor position is changed again. The second byte has 8-bits specifying the column of the new cursor position.
0x000A	New line character used to indicate the end of a row of characters.
0x000B	Same as new line, except apply the current attribute to the last column of the current row. This is used to allow setting text for the first part of a row, but applying an attribute like title or highlight to the entire row.
0x000C	Clear the screen. This acts the same as the Clear Display dynamic flag, clearing the screen to all space characters with the attribute set from the current attribute.
0x001B	Escape character used to indicate that the following byte in the character data stream is a character attribute byte to set the current text attribute. The attribute will apply to all following characters until it is changed again.

Table 20.7: Display Data Extended Character Codes

### 20.1.2 Display Control

Usage Name	Usage Type	Description
<b>Display Control Report</b>	CL	Identifies the report associated with controlling the features of the display device.
Clear Display	DF	Clears the display to blanks (spaces) and returns the cursor to the home position. This is a write-only control that returns 0 when read. Clear Display is a single-bit data field where 0 is no operation and 1 clears the display.
Display Enable	DF	Turns the display on or off. Display Enable is a single-bit data field where: 0 is display off and 1 is display on. If this usage is absent from the <b>Report</b> descriptor, assume that the display is always enabled.
Screen Saver Delay	SV/DV	The delay in milliseconds between setting Screen Saver Enable and the time that the screen save operation actually takes place.
Display Brightness	DV	This usage allows the brightness of the display to be adjusted.
Display Contrast	DV	This usage allows the contrast of the display to be adjusted.
Screen Saver Enable	DF	When enabled, the display will either put up a vendor-defined screen saver or turn the display off after the Screen Saver Delay. If this usage is absent from the <b>Report</b> descriptor, assume that the display does not support this feature.

### 20.1.3 Scrolling

If Horizontal Scrolling and Vertical Scrolling are disabled, characters received after the cursor reaches the right-most column ( $Column = Columns$ ) will overwrite each other.

There are three scrolling modes: none, horizontal and vertical. Only one mode can be operative at a time. That is, Horizontal Scrolling and Vertical Scrolling are mutually exclusive.

- When Vertical Scrolling is enabled, if the cursor is on the last character of a row ( $Column = Columns$ ) other than the last row ( $Row \neq Rows$ ), the next character received will cause the vertical cursor position to be incremented ( $Row++$ ) and the horizontal cursor position to be set to 0 ( $Column = 0$ ). If the cursor is on the last character ( $Column = Columns$ ) of the last row ( $Row = Rows$ ), the next character will cause all rows to be scrolled up, the last row to be cleared, and the horizontal cursor position to be set to 0 ( $Column = 0$ ).
- When Horizontal Scrolling is enabled, if the cursor is on the last character of a row ( $Column = Columns$ ), the next character received will cause the row to be scrolled horizontally one character position and the character to be placed on the last column of the row.

Any data that scrolls off the display is lost.

Vertical Scroll or Horizontal Scroll are considered to be Static Flags (SF). That is, if they are not declared, it can be assumed that the mode is not supported. However, if they are defined as Dynamic Flags then the modes can be enabled or disabled.

Usage Name	Usage Type	Description
Vertical Scroll	SF	Indicates whether the display will scroll vertically, where 0 means that the display will not scroll vertically and 1 means that the display will scroll vertically.
Horizontal Scroll	SF	Indicates whether the row will scroll horizontally, where 0 means that the display will not scroll horizontally and 1 means that the display will scroll horizontally.

#### 20.1.4 Character Transfers

An alphanumeric display can be configured to read or write multiple characters in a single message.

Usage Name	Usage Type	Description
<b>Character Report</b>	CL	Identifies the report associated with character data movement. Flow control is handled by the display NAKing Character reports until it is ready for more characters.
Display Data	DV	The report field that is written to pass characters to the display. When read, the character currently indicated by the cursor is returned.  If this field is declared with a <b>Report Count</b> greater than 1, any characters not defined as NoOp will be written to the display. When the same field is read, all characters from the current cursor position forward will be returned. If the range goes beyond the end of the display memory, NoOp characters will be returned.
	Buffered Bytes	When the Display Data field is declared as Buffered Byte, the data in the array is used as an index in to the character ROM of the device. The <b>Report Size</b> will reflect the size of the character set supported by the device.
	NAry	If a vendor wishes to identify specific characters other than those found in the ASCII character set and does not want to send 16-bit Unicode characters to the display, the vendor can describe the Display Data field as a Named Array (NAry) in which the Selector usages are pulled from the Unicode page.
Attribute Data	DV	Writing to this field will modify the attribute values of the character currently indicated by the current cursor. When read, the attribute values of the character currently indicated by the cursor are returned.  This usage is always used in combination with a Display Data usage.  If this usage is declared, a Attribute Display collection must also be declared to define its contents. The Report Size of this field will reflect the size of the data fields as defined in the Attribute Display collection.  If this usage is declared with a Report Count greater than 1, the attributes of multiple characters can be changed simultaneously, starting from the current cursor position. If the Attribute Read Back usage is declared, then the attributes of the characters from the current cursor position forward will be returned when this report is read. If the range goes beyond the end of the display memory, zero data will be returned.

### 20.1.5 Display Status

A display will initially generate a Stat Not Ready status until the display is fully initialized. No commands should be issued to the display until the Stat Ready condition is detected. Any error will be held in Display Status field until it is read, at which point the Display Status field will return to the Stat Ready condition or be set to the next error code.

Usage Name	Usage Type	Description
<b>Display Status</b>	NAry	This is a collection of the status codes that the display supports. The status codes are reported in a single location array.
Stat Not Ready	Sel	The display is not ready for use. These displays are typically slow to initialize.
Stat Ready	Sel	The display is ready for use. No commands can be issued until the Display Status indicates Stat Ready.
Err Not a loadable character	Sel	This error will occur after an attempt is made to load a character from a non-loadable character location.
Err Font data cannot be read	Sel	This error will occur after an attempt is made to read the font bitmap of a character location that the display does not support.

### 20.1.6 Cursor Control

There are two ways of handling cursor positioning:

- The Row and Column fields may be declared with a Report ID that is different from that used by the Data field. This will allow the cursor to be positioned independently of writing characters to the display.
- The Row, Column, and Data can all be in the same report. If either the Row or Column field contains an out-of-range value, the cursor position will not be updated.

In a Display device, the cursor position is applied first, then any characters are written to the display buffer. Reading the Row and Column will provide the current cursor position.

If Cursor Mode is set to increment (1), nothing will happen if a character is entered when the cursor is on the last column of the last row. If a character is entered when the cursor is on the last column of any other row, the cursor will move to the first column of the next row.

If Cursor Mode is set to decrement (0), nothing will happen if a character is entered when the cursor is on the first column of the first row. If a character is entered when the cursor is on the first column of any other row, the cursor will move to the last column of the next row.

Usage Name	Usage Type	Description
<b>Cursor Position Report</b>	CL	Identifies the report associated with cursor positioning.
Row	DV	Identifies or sets the vertical character position of the cursor. A value of 0 is the topmost row.
Column	DV	Identifies or sets the horizontal character position of the cursor. A value of 0 is the leftmost column.
Rows	SV	Identifies the number of rows supported by the display.
Columns	SV	Identifies the number of columns supported by the display.



Cursor Pixel Positioning	SF	Indicates that the display supports pixel-level cursor positioning. Cursor Pixel Positioning is a single-bit data field where 1 means that cursor pixel positioning is enabled and 0 means that character cursor positioning is enabled. If this usage is absent, assume that the display only supports character-level positioning.  If pixel positioning is supported but character positioning is enabled, Character Width plus Character Spacing Horizontal indicate the number of pixels the cursor will move horizontally and Character Height plus Character Spacing Vertical indicate the number of pixels the cursor will move vertically.  <i>Note: If pixel positioning is supported, the Row and Column fields must be large enough to contain either a character or pixel address.</i>
Cursor Mode	DF	Sets the cursor movement direction. After each character code is sent to the display, the cursor can automatically move either right or left. Cursor Mode is a single-bit data field where 0 decrements the cursor position (moves left) and 1 increments the cursor position (moves right). If this usage is absent from the <b>Report</b> descriptor, assume that the cursor position is always incremented.
Cursor Enable	DF	Turns the cursor on or off. Cursor Enable is a single-bit data field where 0 turns the cursor off and 1 turns the cursor on. If this usage is absent from the <b>Report</b> descriptor, assume that the cursor is always enabled.
Cursor Blink	DF	Turns the cursor blinking on or off. Cursor Blink is a single-bit data field where 0 turns blinking off and 1 turns blinking on. If this usage is absent from the <b>Report</b> descriptor, assume that cursor blinking is off.

### 20.1.7 Font Loading

Alphanumeric displays that support loadable fonts will contain the usages described in this section.

To download a font, the report must contain the character code of the destination character and a bufferedbytes data field that contains Character Width times Character Height bits of data. Font Data is organized as sequential rows of pixels where the least significant bit contains the pixel in the upper right corner of the character.

Not all displays support downloading of all character locations, so the Display Status field should be checked after each download to ensure that the operation completed successfully. An *Err Not a loadable character* value will be returned in the Display Status field if an error occurred.

Not all displays support uploading of all character locations so the Display Status field should be checked after each upload to ensure that the operation completed successfully. An *Err Font data cannot be read* value will be returned in the Display Status field if an error occurred.

Usage Name	Usage Type	Description
<b>Font Report</b>	CL	Finding this usage in a display application descriptor indicates that the display supports downloadable fonts. This usage is applied to a logical collection that defines the font download report.
Font Data	Buffered Bytes	A buffered-bytes data field that contains the font data.

The following usages define display parameters. These are normally static values defined in a **Feature** report.

The Character Spacing Horizontal and Character Spacing Vertical values indicate whether the intercharacter spacing must be included in the downloaded font character or whether it is automatically set by the physical pixel layout of the display. A Character Spacing of 0 implies that any inter-character spacing must be included in the downloaded font. If a Character Spacing (Horizontal or Vertical) usage is not declared, it can be assumed that the respective inter-character spacing is forced by the physical pixel layout of the display and Character Spacing can therefore be assumed to be 1.

Usage Name	Usage Type	Description
Character Width	SV	Identifies the width of a character in pixels.
Character Height	SV	Identifies the height of a character in pixels.
Character Spacing Horizontal	SV	Identifies the horizontal distance between characters in pixels.
Character Spacing Vertical	SV	Identifies the vertical distance between characters in pixels.

## 20.1.8 Character Formats

A variety of character formats are supported: Matrix, 7-Segment and 14-Segment. The default format is a matrix of segments that are used to form characters. The Font 7-Segment and Font 14-Segment static flags are used to identify the respective character format. The absence of either of these flags implies a matrix type display.

### 20.1.8.1 Matrix

A matrix display uses an array of individual segments to display characters and other symbols. Below is a typical example is a 5x7 matrix of segments, separated from adjacent characters by one segment space.

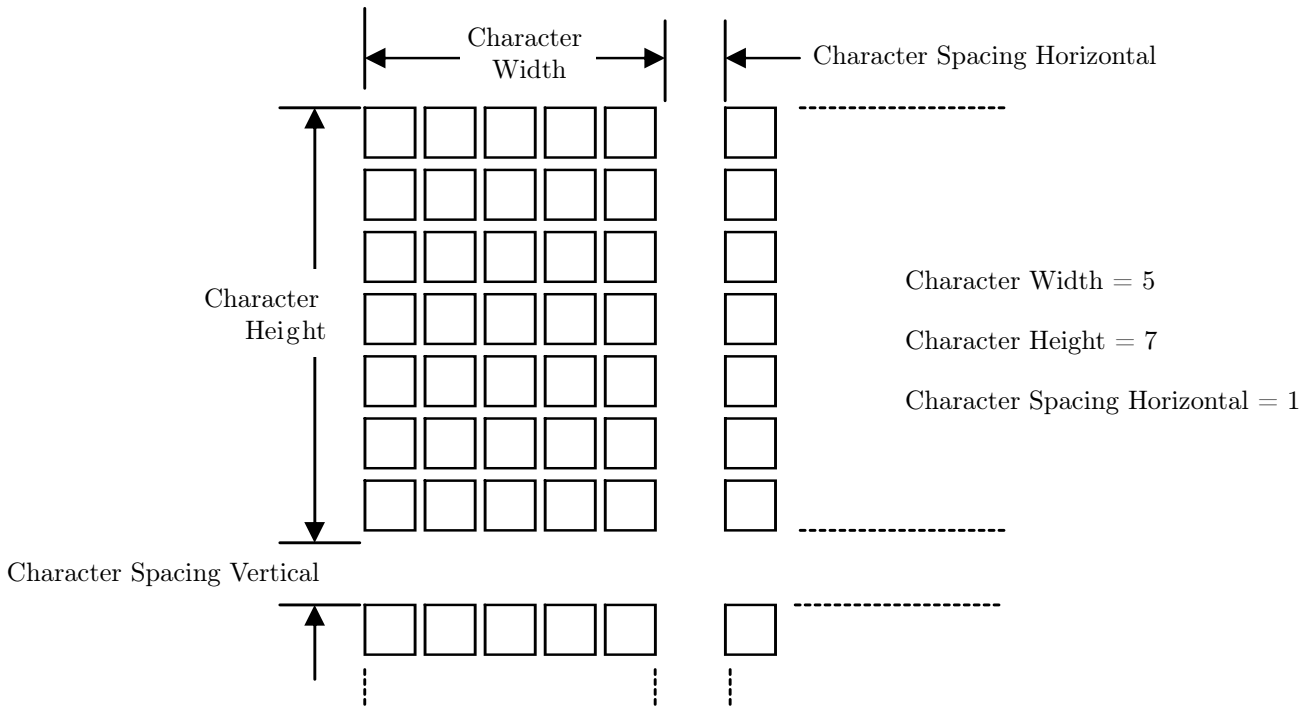


Figure 20.1: Matrix Character Segment Mapping

Matrix fonts are addressed as a packed array of segments, from left to right, top to bottom. Character Spacing segments are ignored.

### 20.1.8.2 7-Segment

A 7-segment character is defined as segments A through G. The segments are mapped to bits in a character byte. The decimal point is handled separately as the most significant bit of the character data. Since the definition of a 7-segment display only requires 8 bits, ASCII mapping is not required. The 7-Segment Direct Map usage can be defined to indicate that ASCII character mappings do not apply to the data received by the display.

*Note: For 7-segment displays, the Character Width, Character Height, Character Spacing Horizontal and Character Spacing Vertical usages have no meaning.*

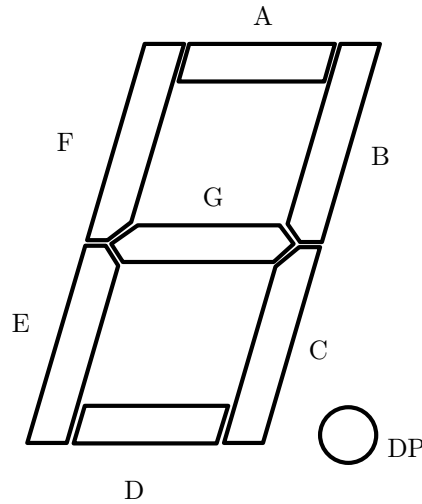


Figure 20.2: 7-Segment Character Segment Mapping

Digit	ASCII	Font Data
00	30	3F
01	31	06
02	32	5D
03	33	4F
04	34	66
05	35	6D
06	36	7D
07	37	07
08	38	7F
09	39	6F
0A	41	37
0B	42	7C
0C	43	39
0D	44	5E
0E	45	79
0F	46	71

Table 20.15: Example 7-Segment Font values for Hex digits

*Note: 0x0B and 0x0D must be expressed as lower case so that they are not confused with 8 and 0, respectively.*

### 20.1.8.3 14-Segment

A 14-segment character is defined as segments A through N. The segments are mapped to bits in a 16-bit value. The decimal point is handled separately as the most significant bit of the character data.

*Note: For 14-segment displays, the Character Width, Character Height, Character Spacing Horizontal and Character Spacing Vertical usages have no meaning.*

Figure 20.1.8.3 shows the segment mapping of 14-segment font characters for a display that supports font loading.

Byte	Bit							
	0	1	2	3	4	5	6	7
0	A	B	C	D	E	F	G	H
1	I	J	K	L	M	N	Unused	Unused

Table 20.16: 14-Segment Font Data

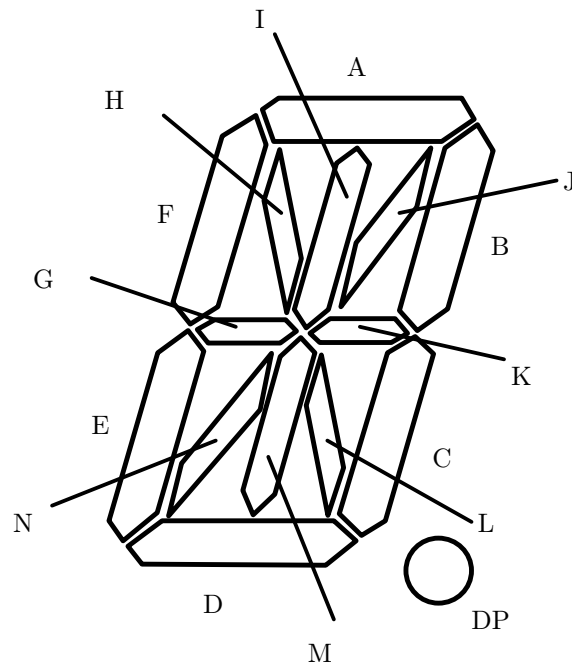


Figure 20.3: 14-Segment Character Segment Mapping

## 20.2 Bitmapped Display

There are 3 types of Bit Depth Formats supported:

- Monochrome, where a pixel value is interpreted as a monochrome intensity.
- Indexed, where a pixel value is either used as an index into a palette table to determine the color to be displayed.
- RGB, where each pixel value contains the respective color component values to be displayed.

Some Bit Depth formats support an Alpha channel. The following formula is applied to each color when calculating the resulting displayed pixel value.

$$\text{DisplayedPixelComponent} = (\text{BlitDataComponent} \times \text{Alpha}) + (\text{FrameBufferDataComponent} \times (\text{MaximumPossibleAlphaValue} - \text{Alpha}))$$

Where a *component* is the R, G, or B value of the an RGB pixel or the brightness value of a monochromatic display. The `MaximumPossibleAlphaValue` is 1 for a 1 bit Alpha value or 255 for an 8-bit Alpha value.

Usage Name	Usage Type	Description
Auxiliary Display	CA	A collection of auxiliary display related usages.

### 20.2.1 Display Attributes Report

The usages defined in this section must be contained in a Display Attributes Report feature report, which declares the basic capabilities of the device.

#### 20.2.1.1 Display Specification

Usage Name	Usage Type	Description
Bitmap Size X	SV	Specifies the X Resolution -1 of the bitmap segment on the display.
Bitmap Size Y	SV	Specifies the Y Resolution -1 of the bitmap segment on the display.

#### 20.2.1.2 Bit Depth Format

Usage Name	Usage Type	Description
Bit Depth Format	SV	ID of the bit depth format supported by the device. The format specifies whether the display is Indexed or RGB, Monochrome or Color, and the bit depth and format of the pixel data. See the Indexed and RGB Formats described below for more details.
Bit Depth Format	DV	If multiple Bit Depth formats are supported by a display then multiple Bit Depth Format usages will be declared in a Display Attributes Report. And a Bit Depth usage must be declared in a feature report to allow the client to set the current bit depth format.

#### 20.2.1.3 Monochrome and Indexed Formats

An Indexed format is specified by OR'ing it with an RGB BitDepth format value. The resulting value not only specifies the size of the palette table, but the RGB format of its entries. For instance, a BitDepth Format value of 0x13 indicates the palette has 16 entries, where each entry supports a 555 RGB color value.

It is not legal to declare an RGB Format that supports Alpha channels for an Indexed format.

A Palette Report must be declared if an Indexed format is defined. For Indexed formats the system is responsible for initializing all palette entries. For Monochrome formats, a 0 pixel value displays the background color and the maximum pixel value displays the foreground or Active color at maximum intensity.

Val	Title	Description
01	BitDepth Indexed 1 Bit	Specifies the display supports a pixel bit depth of 1 bit. If an Indexed format is specified, the palette table will contain 2 entries for specifying two possible colors, where pixel value is the index into the palette table. If a Monochrome format is declared, a 0x0 value displays the Background color for the pixel and a value of 1 displays is the Active color at maximum intensity.
02	BitDepth Indexed 2 Bits	Specifies the display supports a bit depth of 2 bits. If an Indexed format is specified, the palette table will contain 4 entries. Not finding a Palette Report indicates a Monochrome format, where a 0x0 value displays the Background color for the pixel and a value of 3 displays is the Active color at maximum intensity.
03	BitDepth Indexed 4 Bits	Specifies the display supports a bit depth of 4 bits. If an Indexed format is specified, the palette table will contain 16 entries. If a Monochrome format is declared, a 0x0 value displays the Background color for the pixel and a value of 0xF displays is the Active color at maximum intensity.
04	BitDepth Indexed 8 Bits	Specifies the display supports a bit depth of 8 bits. If an Indexed format is specified, the palette table will contain 256 entries. If a Monochrome format is declared, a 0x0 value displays the Background color for the pixel and a value of 0xFF displays is the Active color at maximum intensity.

#### 20.2.1.4 RGB Formats

*Note: bit 8 of the usage value is asserted if an alpha channel is supported.*

Val	Title	Description
04	BitDepth Indexed 8 Bits	Specifies the display supports a bit depth of 8 bits. If an Indexed format is specified, the palette table will contain 256 entries. If a Monochrome format is declared, a 0x0 value displays the Background color for the pixel and a value of 0xFF displays is the Active color at maximum intensity.
10	BitDepth RGB 555	Specifies the display supports a bit depth of 15 bits in a 16-bit value. Finding this usage specifies that a Palette Report is invalid. Bits 0-4 indicate the red aspect of a specific pixel. Bits 5-9 indicate the green aspect of the specific pixel. Bits 10-14 indicate the blue aspect of the indexed pixel. Bit 15 is unused in this pixel bit depth.
90	BitDepth ARGB 1555	Specifies the display supports a bit depth of 16 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-4 indicate the red aspect of a specific pixel. Bits 5-9 indicate the green aspect of the specific pixel. Bits 10-14 indicate the blue aspect of the indexed pixel. Bit 15 is the alpha value of the pixel.
20	BitDepth RGB 565	Specifies the display supports a bit depth of 16 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-4 indicate the red aspect of a specific pixel. Bits 5-10 indicate the green aspect of the specific pixel. Bits 11-15 indicate the blue aspect of the indexed pixel.
30	BitDepth RGB 888	Specifies the display supports a bit depth of 24 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-7 indicate the red aspect of a specific pixel. Bits 8-15 indicate the green aspect of the specific pixel. Bits 16-23 indicate the blue aspect of the indexed pixel.
C0	BitDepth ARGB 8888	Specifies the display supports a bit depth of 32 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-7 indicate the red aspect of a specific pixel. Bits 8-15 indicate the green aspect of the specific pixel. Bits 16-24 indicate the blue aspect of the indexed pixel. Bits 25-31 indicate the alpha value of the pixel.

0A	BitDepth PARGB 8888	Specifies the display supports a bit depth of 32 bits. Finding this usage specifies that a Palette Report is invalid. The first 8 bit is the alpha value of the pixel. Note that the alpha value should be calculated into the following 24 bits of the pixel data. The second 8 bits indicate the red aspect of a specific pixel. The third 8 bits indicate the green aspect of the specific pixel. The fourth 8 bits indicate the blue aspect of the indexed pixel.
40	BitDepth 8880	Specifies the display supports a bit depth of 32 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-7 indicate the red aspect of a specific pixel. Bits 8-15 indicate the green aspect of the specific pixel. Bits 16-23 indicate the blue aspect of the indexed pixel. Bits 24-31 of the pixel data should be set to 0 and are ignored by the display.

### 20.2.1.5 Soft Buttons

Soft (unlabeled) Buttons can be positioned around the edges of the display. Knowing the position of the button, an application can render text or an icon close to the button that has the associated function, defining its purpose.

The existence of a Soft Button collection in a Report descriptor indicates that the device supports Soft Buttons. A Soft Button collection defines the position of soft button. This information is normally retrieved at initialization time. During run time, input reports are generated to indicate changes in the state of a button.

*Note: The button collection will include usages from the functional [Button Page \(0x09\)](#) in order to represent hardware buttons with an associated function.*

Usage Name	Usage Type	Description
<b>Soft Button</b>	CL	This usage encapsulates 4 usages that define a Soft Button. The usages are; a Button Usage Page declaration that defines button number, and Soft Button Offset 1, Soft Button Offset 2, and Soft Button Side that defined the position of the button on the periphery of the display. A Soft Button collection is declared for each soft button present on the display.
Soft Button ID	SV	Specifies the Y Resolution -1 of the bitmap segment on the display.
Soft Button Side	SV	This usage specifies the side of the display where the button resides. Where, 0 = top, 1 = bottom, 2 = left side. 3 = right side.
Soft Button Offset 1	SV	A static value that specifies the offset in pixels of the top or left edge of the button. If the Soft Button Side usage equals <i>top</i> or <i>bottom</i> then the offset is in the column position of the side of the button nearest the origin. If the Soft Button Side usage equals <i>right</i> or <i>left</i> then the offset is in the row position of the side of the button nearest the origin.
Soft Button Offset 2	SV	A static value that specifies the offset in pixels of the bottom or right edge of the button. If the Soft Button Side usage equals <i>top</i> or <i>bottom</i> then the offset is in the column position of the side of the button farthest from the origin. If the Soft Button Side usage equals <i>right</i> or <i>left</i> then the offset is in the row position of the side of the button farthest from the origin.

## 20.2.2 Orientation

Pixels are addressed in row and columns. The origin or 0,0 position is always in the upper left hand corner of the display. Below is an example of a 128x64 bitmapped display.

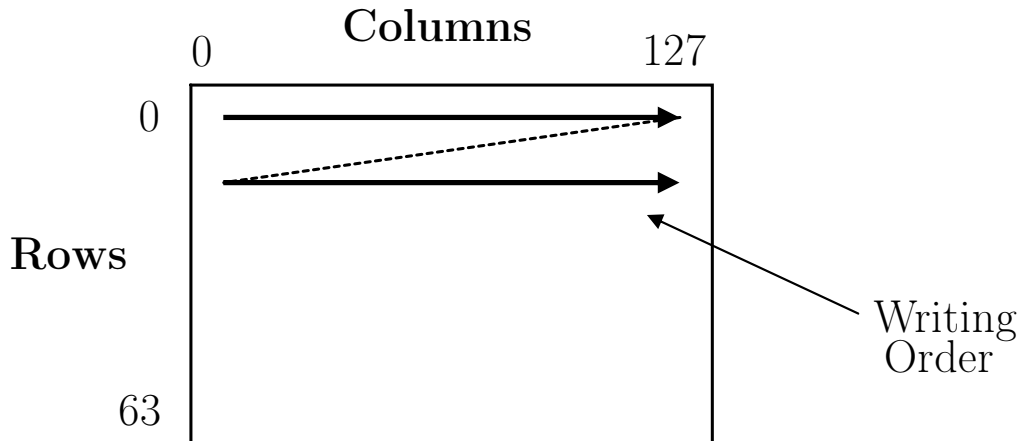


Figure 20.4: Display Orientation and Writing Order

Usage Name	Usage Type	Description
Display Orientation	DV	<p>This usage is declared if the orientation of the display can be changed during usage. It identifies the location of the origin as viewed by the user. <i>Note: the application must perform the translations necessary to correctly display the screen to the user given the Orientation information.</i></p> <ul style="list-style-type: none"> <li>• 0 – Origin at top left (default)</li> <li>• 1 – Origin at top right (rotated 90°clockwise)</li> <li>• 2 – Origin at bottom right (rotated 180°clockwise)</li> <li>• 3 – Origin at bottom left (rotated 270°clockwise)</li> </ul>

## 20.2.3 Palette Report

Usage Name	Usage Type	Description
Palette Report	CL	Finding this usage in a display application descriptor indicates the Bitmapped Display supports loadable Palettes. This usages applies to a logical collection that defines the palette download report.
Palette Data Size	SV	Specifies the number of palette table entries contained in the Palette Data buffered bytes field.
Palette Data Offset	SV	Specifies the offset into the palette table of the first entry contained in the Palette Data buffered bytes field. This field can be optional if the Palette Data Size is large enough to initialize the complete Palette table at once. If not declared, then the all Palette table entries must be included in a Palette Rptr report.
Palette Data	Buffered Bytes	A collection of buffered bytes data that contains the palette data. The size of the individual palette entries are determined by the Bit Depth Format, see the descriptions above. If a Palette Data Offset is declared then the palette entries are loaded into the palette table starting at the offset declared by the Palette Data Offset. If a Palette Data Offset is not declared then the palette entries are loaded into the palette table starting at offset 0.



## 20.2.4 Blit Report

The following Blit Rectangle coordinates specify the bounding rectangle X1, Y1, X2, Y2 where the Blit Data buffer will be moved. The coordinate values assume the default Orientation of the display.

If no Blit Rectangle usages are declared, then the client should assume that the data provided in the Blit Data is for the entire display buffer. i.e. the blit rectangle is (0,0, Bitmap Size X – 1, Bitmap Size Y – 1).

If a coordinate of the bounding rectangle is outside the boundaries of the display, the display will ignore data for this part of the Blit Data Buffer.

Usage Name	Usage Type	Description
<b>Blit Report</b>	CL	This usage is required for moving data to or from a Bitmapped Display Device.
Blit Rectangle X1	DV	Specifies the X component of the top left corner of the rectangle for the blit.
Blit Rectangle Y1	DV	Specifies the Y component of the top left corner of the rectangle for the blit.
Blit Rectangle X2	DV	Specifies the X component of the bottom right corner of the rectangle for the blit.
Blit Rectangle Y2	DV	Specifies the Y component of the bottom right corner of the rectangle for the blit.
Blit Data	Buffered Bytes	The buffer that contains the pixel data for each pixel in a blit to a display. The number of pixels contained in the Blit Data buffer equals:  $(BlitRectangleX1 - BlitRectangleX2) \times (BlitRectangleY1 - BlitRectangleY2)$ .  The format of the pixel data is a function of the Bit Depth Format, see Section <a href="#">20.2.1.2 Bit Depth Format</a>
Max Blit Size	SV	The maximum size of a blit (in bytes) that is supported by the display. <sup>1</sup>

## 20.2.5 Soft Button Report

Usage Name	Usage Type	Description
Soft Button Report	SV	The Soft Button Report collection will include usages from <a href="#">Button Page (0x09)</a> , which provides usages for generic non-function based button usages. The IDs of these buttons are defined in a Soft Button collection.

<sup>1</sup>Alternatively the maximum size of a blit (in bytes) that is supported by the display, is defined by the size of the buffered bytes field in the Blit Report.

## 20.3 Character Maps

It is usually the case that an alphanumeric display device is capable of supporting only a subset of displayable characters. For Unicode characters in particular since the character set is so large that often only some of the characters can be displayed. To allow the host to determine which characters are displayable, the following HID usages are defined to map Unicode UTF-16LE character codes to any of the device characters.

Usage Name	Usage Type	Description
Character Mapping	SV	Display data byte which maps to an associated Unicode Equivalent.
Unicode Equivalent	SV	Always 16 bits, this is the UTF-16LE code for the character mapped to the associated display data byte.
Character Page Mapping	SV	A Buffered Byte array of 256 values, one for each 256 byte character page used when the Unicode display attribute is present. The value tells whether the page of 256 bytes is used, matches Unicode UTF16-LE directly or has a full or partial character map.

Value	Definition
0x00	Page Not Used
0x01	Page Matches Unicode UTF-16 LE
0x02	Character Page Mapping returns partial map
0x03	Character Page Mapping returns full map

Table 20.28: Page Mapping Definitions

## 20.4 Requesting Reports

In some cases, the host may require the device to return a specific HID report. If the device supports these requests, it can define an input report with the following usage and when received return the specified output report.

Usage Name	Usage Type	Description
Request Report	DV	Report ID of the requested output report.

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- The lowest-numbered IDs from 0x00 to 0xFF are Usages applied to Collections and represent sensor objects (may equate to sensor *Categories* or *Types*).
- The IDs from 0x0100 to 0x07FF are Usages applied to *Properties* and *Data Fields*. These are grouped by the sensor *Category* where the Usages are commonly employed, but this arrangement is arbitrary. Usages may be reported by any sensor (or more than one sensor) if it makes sense to do so. Properties and Data Fields can also apply to Collections within a Collection described by a Categories or Types Usage.
- The IDs from 0x0300 to 0x03FF and 0x0529 (timestamp) are commonly used with all Sensors.
- The IDs from 0x0800 to 0x0FFF are *Selector* Usages used with *Properties* or *Data Fields* that are *Named Array* enumerations. Selectors can also apply to Collections within a Collection described by a Categories or Types Usage.
- The IDs from 0x1000 to 0xEFFF are *Properties* or *Data Fields* from the 0x0100 to 0x0FFF range with *Modifiers* OR-ed in to the top 4 bits. *Note: 0x0100 to 0x0FFF are the base usages without Modifiers*
- The IDs from 0xF000 upward are reserved for proprietary use by vendors.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Sensor</b> [12]	CA/CP	21.1
02-0F	<i>Reserved</i>		
10	<b>Biometric</b> [12]	CA/CP	21.1
11	<b>Biometric: Human Presence</b> [12]	CA/CP	21.1
12	<b>Biometric: Human Proximity</b> [12]	CA/CP	21.1
13	<b>Biometric: Human Touch</b> [12]	CA/CP	21.1
14	<b>Biometric: Blood Pressure</b> [30]	CA/CP	21.1
15	<b>Biometric: Body Temperature</b> [30]	CA/CP	21.1
16	<b>Biometric: Heart Rate</b> [30]	CA/CP	21.1
17	<b>Biometric: Heart Rate Variability</b> [30]	CA/CP	21.1
18	<b>Biometric: Peripheral Oxygen Saturation</b> [30]	CA/CP	21.1
19	<b>Biometric: Respiratory Rate</b> [30]	CA/CP	21.1
1A-1F	<i>Reserved</i>		
20	<b>Electrical</b> [12]	CA/CP	21.1
21	<b>Electrical: Capacitance</b> [12]	CA/CP	21.1
22	<b>Electrical: Current</b> [12]	CA/CP	21.1
23	<b>Electrical: Power</b> [12]	CA/CP	21.1
24	<b>Electrical: Inductance</b> [12]	CA/CP	21.1
25	<b>Electrical: Resistance</b> [12]	CA/CP	21.1
26	<b>Electrical: Voltage</b> [12]	CA/CP	21.1
27	<b>Electrical: Potentiometer</b> [12]	CA/CP	21.1
28	<b>Electrical: Frequency</b> [12]	CA/CP	21.1
29	<b>Electrical: Period</b> [12]	CA/CP	21.1
2A-2F	<i>Reserved</i>		
30	<b>Environmental</b> [12]	CA/CP	21.1

31	<b>Environmental: Atmospheric Pressure</b> [12]	CA/CP	21.1
32	<b>Environmental: Humidity</b> [12]	CA/CP	21.1
33	<b>Environmental: Temperature</b> [12]	CA/CP	21.1
34	<b>Environmental: Wind Direction</b> [12]	CA/CP	21.1
35	<b>Environmental: Wind Speed</b> [12]	CA/CP	21.1
36	<b>Environmental: Air Quality</b> [30]	CA/CP	21.1
37	<b>Environmental: Heat Index</b> [30]	CA/CP	21.1
38	<b>Environmental: Surface Temperature</b> [30]	CA/CP	21.1
39	<b>Environmental: Volatile Organic Compounds</b> [30]	CA/CP	21.1
3A	<b>Environmental: Object Presence</b> [50]	CA/CP	21.1
3B	<b>Environmental: Object Proximity</b> [50]	CA/CP	21.1
3C-3F	<i>Reserved</i>		
40	<b>Light</b> [12]	CA/CP	21.1
41	<b>Light: Ambient Light</b> [12]	CA/CP	21.1
42	<b>Light: Consumer Infrared</b> [12]	CA/CP	21.1
43	<b>Light: Infrared Light</b> [30]	CA/CP	21.1
44	<b>Light: Visible Light</b> [30]	CA/CP	21.1
45	<b>Light: Ultraviolet Light</b> [30]	CA/CP	21.1
46-4F	<i>Reserved</i>		
50	<b>Location</b> [12]	CA/CP	21.1
51	<b>Location: Broadcast</b> [12]	CA/CP	21.1
52	<b>Location: Dead Reckoning</b> [12]	CA/CP	21.1
53	<b>Location: GPS (Global Positioning System)</b> [12]	CA/CP	21.1
54	<b>Location: Lookup</b> [12]	CA/CP	21.1
55	<b>Location: Other</b> [12]	CA/CP	21.1
56	<b>Location: Static</b> [12]	CA/CP	21.1
57	<b>Location: Triangulation</b> [12]	CA/CP	21.1
58-5F	<i>Reserved</i>		
60	<b>Mechanical</b> [12]	CA/CP	21.1
61	<b>Mechanical: Boolean Switch</b> [12]	CA/CP	21.1
62	<b>Mechanical: Boolean Switch Array</b> [12]	CA/CP	21.1
63	<b>Mechanical: Multivalued Switch</b> [12]	CA/CP	21.1
64	<b>Mechanical: Force</b> [12]	CA/CP	21.1
65	<b>Mechanical: Pressure</b> [12]	CA/CP	21.1
66	<b>Mechanical: Strain</b> [12]	CA/CP	21.1
67	<b>Mechanical: Weight</b> [12]	CA/CP	21.1
68	<b>Mechanical: Haptic Vibrator</b> [12]	CA/CP	21.1
69	<b>Mechanical: Hall Effect Switch</b> [12]	CA/CP	21.1
6A-6F	<i>Reserved</i>		

70	<b>Motion</b> [12]	CA/CP	21.1
71	<b>Motion: Accelerometer 1D</b> [12]	CA/CP	21.1
72	<b>Motion: Accelerometer 2D</b> [12]	CA/CP	21.1
73	<b>Motion: Accelerometer 3D</b> [12]	CA/CP	21.1
74	<b>Motion: Gyrometer 1D</b> [12]	CA/CP	21.1
75	<b>Motion: Gyrometer 2D</b> [12]	CA/CP	21.1
76	<b>Motion: Gyrometer 3D</b> [12]	CA/CP	21.1
77	<b>Motion: Motion Detector</b> [12]	CA/CP	21.1
78	<b>Motion: Speedometer</b> [12]	CA/CP	21.1
79	<b>Motion: Accelerometer</b> [12]	CA/CP	21.1
7A	<b>Motion: Gyrometer</b> [12]	CA/CP	21.1
7B	<b>Motion: Gravity Vector</b> [30]	CA/CP	21.1
7C	<b>Motion: Linear Accelerometer</b> [30]	CA/CP	21.1
7D-7F	<i>Reserved</i>		
80	<b>Orientation</b> [12]	CA/CP	21.1
81	<b>Orientation: Compass 1D</b> [12]	CA/CP	21.1
82	<b>Orientation: Compass 2D</b> [12]	CA/CP	21.1
83	<b>Orientation: Compass 3D</b> [12]	CA/CP	21.1
84	<b>Orientation: Inclinometer 1D</b> [12]	CA/CP	21.1
85	<b>Orientation: Inclinometer 2D</b> [12]	CA/CP	21.1
86	<b>Orientation: Inclinometer 3D</b> [12]	CA/CP	21.1
87	<b>Orientation: Distance 1D</b> [12]	CA/CP	21.1
88	<b>Orientation: Distance 2D</b> [12]	CA/CP	21.1
89	<b>Orientation: Distance 3D</b> [12]	CA/CP	21.1
8A	<b>Orientation: Device Orientation</b> [12]	CA/CP	21.1
8B	<b>Orientation: Compass</b> [12]	CA/CP	21.1
8C	<b>Orientation: Inclinometer</b> [12]	CA/CP	21.1
8D	<b>Orientation: Distance</b> [12]	CA/CP	21.1
8E	<b>Orientation: Relative Orientation</b> [30]	CA/CP	21.1
8F	<b>Orientation: Simple Orientation</b> [30]	CA/CP	21.1
90	<b>Scanner</b> [12]	CA/CP	21.1
91	<b>Scanner: Barcode</b> [12]	CA/CP	21.1
92	<b>Scanner: RFID</b> [12]	CA/CP	21.1
93	<b>Scanner: NFC</b> [12]	CA/CP	21.1
94-9F	<i>Reserved</i>		
A0	<b>Time</b> [12]	CA/CP	21.1
A1	<b>Time: Alarm Timer</b> [12]	CA/CP	21.1
A2	<b>Time: Real Time Clock</b> [12]	CA/CP	21.1
A3-AF	<i>Reserved</i>		

B0	<b>Personal Activity</b> [30]	CA/CP	21.1
B1	<b>Personal Activity: Activity Detection</b> [30]	CA/CP	21.1
B2	<b>Personal Activity: Device Position</b> [30]	CA/CP	21.1
B3	<b>Personal Activity: Pedometer</b> [30]	CA/CP	21.1
B4	<b>Personal Activity: Step Detection</b> [30]	CA/CP	21.1
B5-BF	<i>Reserved</i>		
C0	<b>Orientation Extended</b> [30]	CA/CP	21.1
C1	<b>Orientation Extended: Geomagnetic Orientation</b> [30]	CA/CP	21.1
C2	<b>Orientation Extended: Magnetometer</b> [30]	CA/CP	21.1
C3-CF	<i>Reserved</i>		
D0	<b>Gesture</b> [60]	CA/CP	21.1
D1	<b>Gesture: Chassis Flip Gesture</b> [60]	CA/CP	21.1
D2	<b>Gesture: Hinge Fold Gesture</b> [60]	CA/CP	21.1
D3-DF	<i>Reserved</i>		
E0	<b>Other</b> [12]	CA/CP	21.1
E1	<b>Other: Custom</b> [12]	CA/CP	21.1
E2	<b>Other: Generic</b> [12]	CA/CP	21.1
E3	<b>Other: Generic Enumerator</b> [12]	CA/CP	21.1
E4	<b>Other: Hinge Angle</b> [59]	CA/CP	21.1
E5-EF	<i>Reserved</i>		
F0	<b>Vendor Reserved 1</b> [12]	CA/CP	21.1
F1	<b>Vendor Reserved 2</b> [12]	CA/CP	21.1
F2	<b>Vendor Reserved 3</b> [12]	CA/CP	21.1
F3	<b>Vendor Reserved 4</b> [12]	CA/CP	21.1
F4	<b>Vendor Reserved 5</b> [12]	CA/CP	21.1
F5	<b>Vendor Reserved 6</b> [12]	CA/CP	21.1
F6	<b>Vendor Reserved 7</b> [12]	CA/CP	21.1
F7	<b>Vendor Reserved 8</b> [12]	CA/CP	21.1
F8	<b>Vendor Reserved 9</b> [12]	CA/CP	21.1
F9	<b>Vendor Reserved 10</b> [12]	CA/CP	21.1
FA	<b>Vendor Reserved 11</b> [12]	CA/CP	21.1
FB	<b>Vendor Reserved 12</b> [12]	CA/CP	21.1
FC	<b>Vendor Reserved 13</b> [12]	CA/CP	21.1
FD	<b>Vendor Reserved 14</b> [12]	CA/CP	21.1
FE	<b>Vendor Reserved 15</b> [12]	CA/CP	21.1
FF	<b>Vendor Reserved 16</b> [12]	CA/CP	21.1
100-1FF	<i>Reserved</i>		
200	<b>Event</b> [12]	DV	21.3
201	<b>Event: Sensor State</b> [12]	NArY	21.3

202	<b>Event: Sensor Event</b> [12]	NAry	21.4
203-2FF	<i>Reserved</i>		
300	Property [12]	DV	21.5
301	Property: Friendly Name [12]	SV	21.5
302	Property: Persistent Unique ID [12]	DV	21.5
303	Property: Sensor Status [12]	DV	21.5
304	Property: Minimum Report Interval [12]	SV	21.5
305	Property: Sensor Manufacturer [12]	SV	21.5
306	Property: Sensor Model [12]	SV	21.5
307	Property: Sensor Serial Number [12]	SV	21.5
308	Property: Sensor Description [12]	SV	21.5
309	<b>Property: Sensor Connection Type</b> [12]	NAry	21.5.1
30A	Property: Sensor Device Path [12]	DV	21.5
30B	Property: Hardware Revision [12]	SV	21.5
30C	Property: Firmware Version [12]	SV	21.5
30D	Property: Release Date [12]	SV	21.5
30E	Property: Report Interval [12]	DV	21.5
30F	Property: Change Sensitivity Absolute [12]	DV	21.5
310	Property: Change Sensitivity Percent of Range [12]	DV	21.5
311	Property: Change Sensitivity Percent Relative [12]	DV	21.5
312	Property: Accuracy [12]	DV	21.5
313	Property: Resolution [12]	DV	21.5
314	Property: Maximum [12]	DV	21.5
315	Property: Minimum [12]	DV	21.5
316	<b>Property: Reporting State</b> [12]	NAry	21.5.2
317	Property: Sampling Rate [12]	DV	21.5
318	Property: Response Curve [12]	DV	21.5
319	<b>Property: Power State</b> [12]	NAry	21.5.3
31A	Property: Maximum FIFO Events [27]	SV	21.5.4
31B	Property: Report Latency [27]	DV	21.5.4
31C	Property: Flush FIFO Events [30]	DF	21.5.4
31D	Property: Maximum Power Consumption [30]	DV	21.5.4
31E	Property: Is Primary [50]	DF	21.5
31F-3FF	<i>Reserved</i>		
400	Data Field: Location [12]	DV	21.10
401-401	<i>Reserved</i>		
402	Data Field: Altitude Antenna Sea Level [12]	SV	21.10
403	Data Field: Differential Reference Station ID [12]	SV	21.10
404	Data Field: Altitude Ellipsoid Error [12]	SV	21.10



405	Data Field: Altitude Ellipsoid [12]	SV	21.10
406	Data Field: Altitude Sea Level Error [12]	SV	21.10
407	Data Field: Altitude Sea Level [12]	SV	21.10
408	Data Field: Differential GPS Data Age [12]	SV	21.10
409	Data Field: Error Radius [12]	SV	21.10
40A	<b>Data Field: Fix Quality [12]</b>	NAry	21.10.2
40B	<b>Data Field: Fix Type [12]</b>	NAry	21.10.3
40C	Data Field: Geoidal Separation [12]	SV	21.10
40D	<b>Data Field: GPS Operation Mode [12]</b>	NAry	21.10.4
40E	<b>Data Field: GPS Selection Mode [12]</b>	NAry	21.10.5
40F	<b>Data Field: GPS Status [12]</b>	NAry	21.10.6
410	Data Field: Position Dilution of Precision [12]	SV	21.10
411	Data Field: Horizontal Dilution of Precision [12]	SV	21.10
412	Data Field: Vertical Dilution of Precision [12]	SV	21.10
413	Data Field: Latitude [12]	SV	21.10
414	Data Field: Longitude [12]	SV	21.10
415	Data Field: True Heading [12]	SV	21.10
416	Data Field: Magnetic Heading [12]	SV	21.10
417	Data Field: Magnetic Variation [12]	SV	21.10
418	Data Field: Speed [12]	SV	21.10
419	Data Field: Satellites in View [12]	SV	21.10
41A	Data Field: Satellites in View Azimuth [12]	SV	21.10
41B	Data Field: Satellites in View Elevation [12]	SV	21.10
41C	Data Field: Satellites in View IDs [12]	SV	21.10
41D	Data Field: Satellites in View PRNs [12]	SV	21.10
41E	Data Field: Satellites in View S/N Ratios [12]	SV	21.10
41F	Data Field: Satellites Used Count [12]	SV	21.10
420	Data Field: Satellites Used PRNs [12]	SV	21.10
421	Data Field: NMEA Sentence [12]	SV	21.10
422	Data Field: Address Line 1 [12]	SV	21.10
423	Data Field: Address Line 2 [12]	SV	21.10
424	Data Field: City [12]	SV	21.10
425	Data Field: State or Province [12]	SV	21.10
426	Data Field: Country or Region [12]	SV	21.10
427	Data Field: Postal Code [12]	SV	21.10
428-429	<i>Reserved</i>		
42A	Property: Location [12]	DV	21.10
42B	<b>Property: Location Desired Accuracy [12]</b>	NAry	21.10.1
42C-42F	<i>Reserved</i>		

430	Data Field: Environmental [12]	SV	21.8
431	Data Field: Atmospheric Pressure [12]	SV	21.8
432-432	<i>Reserved</i>		
433	Data Field: Relative Humidity [12]	SV	21.8
434	Data Field: Temperature [12]	SV	21.8
435	Data Field: Wind Direction [12]	SV	21.8
436	Data Field: Wind Speed [12]	SV	21.8
437	Data Field: Air Quality Index [30]	SV	21.8
438	Data Field: Equivalent CO2 [30]	SV	21.8
439	Data Field: Volatile Organic Compound Concentration [30]	SV	21.8
43A	Data Field: Object Presence [50]	SF	21.8
43B	Data Field: Object Proximity Range [50]	SV	21.8
43C	Data Field: Object Proximity Out of Range [50]	SF	21.8
43D-43F	<i>Reserved</i>		
440	Property: Environmental [12]	SV	21.8
441	Property: Reference Pressure [12]	SV	21.8
442-44F	<i>Reserved</i>		
450	Data Field: Motion [12]	DV	21.12
451	Data Field: Motion State [12]	SF	21.12
452	Data Field: Acceleration [12]	SV	21.12
453	Data Field: Acceleration Axis X [12]	SV	21.12
454	Data Field: Acceleration Axis Y [12]	SV	21.12
455	Data Field: Acceleration Axis Z [12]	SV	21.12
456	Data Field: Angular Velocity [12]	SV	21.12
457	Data Field: Angular Velocity about X Axis [12]	SV	21.12
458	Data Field: Angular Velocity about Y Axis [12]	SV	21.12
459	Data Field: Angular Velocity about Z Axis [12]	SV	21.12
45A	Data Field: Angular Position [12]	SV	21.12
45B	Data Field: Angular Position about X Axis [12]	SV	21.12
45C	Data Field: Angular Position about Y Axis [12]	SV	21.12
45D	Data Field: Angular Position about Z Axis [12]	SV	21.12
45E	Data Field: Motion Speed [12]	SV	21.12
45F	Data Field: Motion Intensity [12]	SV	21.12
460-46F	<i>Reserved</i>		
470	Data Field: Orientation [12]	DV	21.13
471	Data Field: Heading [12]	SV	21.13
472	Data Field: Heading X Axis [12]	SV	21.13
473	Data Field: Heading Y Axis [12]	SV	21.13
474	Data Field: Heading Z Axis [12]	SV	21.13

475	Data Field: Heading Compensated Magnetic North [12]	SV	21.13
476	Data Field: Heading Compensated True North [12]	SV	21.13
477	Data Field: Heading Magnetic North [12]	SV	21.13
478	Data Field: Heading True North [12]	SV	21.13
479	Data Field: Distance [12]	SV	21.13
47A	Data Field: Distance X Axis [12]	SV	21.13
47B	Data Field: Distance Y Axis [12]	SV	21.13
47C	Data Field: Distance Z Axis [12]	SV	21.13
47D	Data Field: Distance Out-of-Range [12]	SF	21.13
47E	Data Field: Tilt [12]	SV	21.13
47F	Data Field: Tilt X Axis [12]	SV	21.13
480	Data Field: Tilt Y Axis [12]	SV	21.13
481	Data Field: Tilt Z Axis [12]	SV	21.13
482	Data Field: Rotation Matrix [12]	SV	21.13
483	Data Field: Quaternion [12]	SV	21.13
484	Data Field: Magnetic Flux [12]	SV	21.13
485	Data Field: Magnetic Flux X Axis [12]	SV	21.13
486	Data Field: Magnetic Flux Y Axis [12]	SV	21.13
487	Data Field: Magnetic Flux Z Axis [12]	SV	21.13
488	<b>Data Field: Magnetometer Accuracy [12]</b>	NAry	21.13.1
489	<b>Data Field: Simple Orientation Direction [30]</b>	NAry	21.13.2
48A-48F	<i>Reserved</i>		
490	Data Field: Mechanical [12]	DV	21.11
491	Data Field: Boolean Switch State [12]	SF	21.11
492	Data Field: Boolean Switch Array States [12]	SV	21.11
493	Data Field: Multivalue Switch Value [12]	SV	21.11
494	Data Field: Force [12]	SV	21.11
495	Data Field: Absolute Pressure [12]	SV	21.11
496	Data Field: Gauge Pressure [12]	SV	21.11
497	Data Field: Strain [12]	SV	21.11
498	Data Field: Weight [12]	SV	21.11
499-49F	<i>Reserved</i>		
4A0	Property: Mechanical [12]	DV	21.11
4A1	Property: Vibration State [12]	DF	21.11
4A2	Property: Forward Vibration Speed [12]	DV	21.11
4A3	Property: Backward Vibration Speed [12]	DV	21.11
4A4-4AF	<i>Reserved</i>		
4B0	Data Field: Biometric [12]	DV	21.6
4B1	Data Field: Human Presence [12]	SF	21.6

4B2	Data Field: Human Proximity Range [12]	SV	21.6
4B3	Data Field: Human Proximity Out of Range [12]	SF	21.6
4B4	Data Field: Human Touch State [12]	SF	21.6
4B5	Data Field: Blood Pressure [12]	SV	21.6
4B6	Data Field: Blood Pressure Diastolic [30]	SV	21.6
4B7	Data Field: Blood Pressure Systolic [30]	SV	21.6
4B8	Data Field: Heart Rate [30]	SV	21.6
4B9	Data Field: Resting Heart Rate [30]	SV	21.6
4BA	Data Field: Heartbeat Interval [30]	SV	21.6
4BB	Data Field: Respiratory Rate [30]	SV	21.6
4BC	Data Field: SpO2 [30]	SV	21.6
4BD-4CF	<i>Reserved</i>		
4D0	Data Field: Light [12]	DV	21.9
4D1	Data Field: Illuminance [12]	SV	21.9
4D2	Data Field: Color Temperature [12]	SV	21.9
4D3	Data Field: Chromaticity [12]	SV	21.9
4D4	Data Field: Chromaticity X [12]	SV	21.9
4D5	Data Field: Chromaticity Y [12]	SV	21.9
4D6	Data Field: Consumer IR Sentence Receive [12]	SV	21.9
4D7	Data Field: Infrared Light [30]	SV	21.9
4D8	Data Field: Red Light [30]	SV	21.9
4D9	Data Field: Green Light [30]	SV	21.9
4DA	Data Field: Blue Light [30]	SV	21.9
4DB	Data Field: Ultraviolet A Light [30]	SV	21.9
4DC	Data Field: Ultraviolet B Light [30]	SV	21.9
4DD	Data Field: Ultraviolet Index [30]	SV	21.9
4DE	Data Field: Near Infrared Light [50]	SV	21.9
4DF	Property: Light [12]	DV	21.9
4E0	Property: Consumer IR Sentence Send [12]	DV	21.9
4E1-4E1	<i>Reserved</i>		
4E2	Property: Auto Brightness Preferred [50]	DF	21.9
4E3	Property: Auto Color Preferred [50]	DF	21.9
4E4-4EF	<i>Reserved</i>		
4F0	Data Field: Scanner [12]	DV	21.14
4F1	Data Field: RFID Tag 40 Bit [12]	SV	21.14
4F2	Data Field: NFC Sentence Receive [12]	SV	21.14
4F3-4F7	<i>Reserved</i>		
4F8	Property: Scanner [12]	DV	21.14
4F9	Property: NFC Sentence Send [12]	SV	21.14

4FA-4FF	<i>Reserved</i>		
500	Data Field: Electrical [12]	SV	21.7
501	Data Field: Capacitance [12]	SV	21.7
502	Data Field: Current [12]	SV	21.7
503	Data Field: Electrical Power [12]	SV	21.7
504	Data Field: Inductance [12]	SV	21.7
505	Data Field: Resistance [12]	SV	21.7
506	Data Field: Voltage [12]	SV	21.7
507	Data Field: Frequency [12]	SV	21.7
508	Data Field: Period [12]	SV	21.7
509	Data Field: Percent of Range [12]	SV	21.7
50A-51F	<i>Reserved</i>		
520	Data Field: Time [12]	DV	21.15
521	Data Field: Year [12]	SV	21.15
522	Data Field: Month [12]	SV	21.15
523	Data Field: Day [12]	SV	21.15
524	<b>Data Field: Day of Week [12]</b>	NAry	21.15.1
525	Data Field: Hour [12]	SV	21.15
526	Data Field: Minute [12]	SV	21.15
527	Data Field: Second [12]	SV	21.15
528	Data Field: Millisecond [12]	SV	21.15
529	Data Field: Timestamp [12]	SV	21.15
52A	Data Field: Julian Day of Year [12]	SV	21.15
52B	Data Field: Time Since System Boot [30]	SV	21.15
52C-52F	<i>Reserved</i>		
530	Property: Time [12]	DV	21.15
531	Property: Time Zone Offset from UTC [12]	DV	21.15
532	Property: Time Zone Name [12]	DV	21.15
533	Property: Daylight Savings Time Observed [12]	DF	21.15
534	Property: Time Trim Adjustment [12]	DV	21.15
535	Property: Arm Alarm [12]	DF	21.15
536-53F	<i>Reserved</i>		
540	Data Field: Custom [12]	DV	21.16
541	Data Field: Custom Usage [12]	SV	21.16
542	Data Field: Custom Boolean Array [12]	SV	21.16
543	Data Field: Custom Value [12]	SV	21.16
544	Data Field: Custom Value 1 [12]	SV	21.16
545	Data Field: Custom Value 2 [12]	SV	21.16
546	Data Field: Custom Value 3 [12]	SV	21.16

547	Data Field: Custom Value 4 [12]	SV	21.16
548	Data Field: Custom Value 5 [12]	SV	21.16
549	Data Field: Custom Value 6 [12]	SV	21.16
54A	Data Field: Custom Value 7 [30]	SV	21.16
54B	Data Field: Custom Value 8 [30]	SV	21.16
54C	Data Field: Custom Value 9 [30]	SV	21.16
54D	Data Field: Custom Value 10 [30]	SV	21.16
54E	Data Field: Custom Value 11 [30]	SV	21.16
54F	Data Field: Custom Value 12 [30]	SV	21.16
550	Data Field: Custom Value 13 [30]	SV	21.16
551	Data Field: Custom Value 14 [30]	SV	21.16
552	Data Field: Custom Value 15 [30]	SV	21.16
553	Data Field: Custom Value 16 [30]	SV	21.16
554	Data Field: Custom Value 17 [30]	SV	21.16
555	Data Field: Custom Value 18 [30]	SV	21.16
556	Data Field: Custom Value 19 [30]	SV	21.16
557	Data Field: Custom Value 20 [30]	SV	21.16
558	Data Field: Custom Value 21 [30]	SV	21.16
559	Data Field: Custom Value 22 [30]	SV	21.16
55A	Data Field: Custom Value 23 [30]	SV	21.16
55B	Data Field: Custom Value 24 [30]	SV	21.16
55C	Data Field: Custom Value 25 [30]	SV	21.16
55D	Data Field: Custom Value 26 [30]	SV	21.16
55E	Data Field: Custom Value 27 [30]	SV	21.16
55F	Data Field: Custom Value 28 [30]	SV	21.16
560	Data Field: Generic [12]	DV	21.18
561	Data Field: Generic GUID or PROPERTYKEY [12]	SV	21.18
562	Data Field: Generic Category GUID [12]	SV	21.18
563	Data Field: Generic Type GUID [12]	SV	21.18
564	Data Field: Generic Event PROPERTYKEY [12]	SV	21.18
565	Data Field: Generic Property PROPERTYKEY [12]	SV	21.18
566	Data Field: Generic Data Field PROPERTYKEY [12]	SV	21.18
567	Data Field: Generic Event [12]	SV	21.18
568	Data Field: Generic Property [12]	SV	21.18
569	Data Field: Generic Data Field [12]	SV	21.18
56A	Data Field: Enumerator Table Row Index [12]	SV	21.18
56B	Data Field: Enumerator Table Row Count [12]	SV	21.18
56C	<b>Data Field: Generic GUID or PROPERTYKEY kind [12]</b>	NArY	21.18.1

56D	Data Field: Generic GUID [12]	SV	21.18
56E	Data Field: Generic PROPERTYKEY [12]	SV	21.18
56F	Data Field: Generic Top Level Collection ID [12]	SV	21.18
570	Data Field: Generic Report ID [12]	SV	21.18
571	Data Field: Generic Report Item Position Index [12]	SV	21.18
572	<b>Data Field: Generic Firmware VARTYPE [12]</b>	NAry	21.18.2
573	<b>Data Field: Generic Unit of Measure [12]</b>	NAry	21.18.3
574	<b>Data Field: Generic Unit Exponent [12]</b>	NAry	21.18.4
575	Data Field: Generic Report Size [12]	SV	21.18
576	Data Field: Generic Report Count [12]	SV	21.18
577-57F	<i>Reserved</i>		
580	Property: Generic [12]	DV	21.18
581	Property: Enumerator Table Row Index [12]	DV	21.18
582	Property: Enumerator Table Row Count [12]	SV	21.18
583-58F	<i>Reserved</i>		
590	Data Field: Personal Activity [30]	DV	21.19
591	<b>Data Field: Activity Type [30]</b>	NAry	21.19.1
592	<b>Data Field: Activity State [30]</b>	NAry	21.19.2
593	<b>Data Field: Device Position [30]</b>	NAry	21.19.3
594	Data Field: Step Count [30]	SV	21.19
595	Data Field: Step Count Reset [30]	DF	21.19
596	Data Field: Step Duration [30]	SV	21.19
597	<b>Data Field: Step Type [30]</b>	NAry	21.19.4
598-59F	<i>Reserved</i>		
5A0	Property: Minimum Activity Detection Interval [30]	DV	21.19
5A1	<b>Property: Supported Activity Types [30]</b>	NAry	21.19
5A2	<b>Property: Subscribed Activity Types [30]</b>	NAry	21.19
5A3	<b>Property: Supported Step Types [30]</b>	NAry	21.19
5A4	<b>Property: Subscribed Step Types [30]</b>	NAry	21.19
5A5	Property: Floor Height [30]	DV	21.19
5A6-5AF	<i>Reserved</i>		
5B0	Data Field: Custom Type ID [30]	SV	21.16
5B1-5BF	<i>Reserved</i>		
5C0	Property: Custom [50]	DV	21.17
5C1	Property: Custom Value 1 [50]	DV	21.17
5C2	Property: Custom Value 2 [50]	DV	21.17
5C3	Property: Custom Value 3 [50]	DV	21.17
5C4	Property: Custom Value 4 [50]	DV	21.17
5C5	Property: Custom Value 5 [50]	DV	21.17

5C6	Property: Custom Value 6 [50]	DV	21.17
5C7	Property: Custom Value 7 [50]	DV	21.17
5C8	Property: Custom Value 8 [50]	DV	21.17
5C9	Property: Custom Value 9 [50]	DV	21.17
5CA	Property: Custom Value 10 [50]	DV	21.17
5CB	Property: Custom Value 11 [50]	DV	21.17
5CC	Property: Custom Value 12 [50]	DV	21.17
5CD	Property: Custom Value 13 [50]	DV	21.17
5CE	Property: Custom Value 14 [50]	DV	21.17
5CF	Property: Custom Value 15 [50]	DV	21.17
5D0	Property: Custom Value 16 [50]	DV	21.17
5D1-5DF	<i>Reserved</i>		
5E0	Data Field: Hinge [59]	SV/DV	21.20.1
5E1	Data Field: Hinge Angle [59]	SV/DV	21.20.1
5E2-5EF	<i>Reserved</i>		
5F0	Data Field: Gesture Sensor [60]	DV	21.20.2.3
5F1	<b>Data Field: Gesture State [60]</b>	NAry	21.20.2.4
5F2	Data Field: Hinge Fold Initial Angle [60]	SV	21.20.2.3
5F3	Data Field: Hinge Fold Final Angle [60]	SV	21.20.2.3
5F4	<b>Data Field: Hinge Fold Contributing Panel [60]</b>	NAry	21.20.2.5
5F5	<b>Data Field: Hinge Fold Type [60]</b>	NAry	21.20.2.6
5F6-7FF	<i>Reserved</i>		
800	Sensor State: Undefined [12]	Sel	21.3
801	Sensor State: Ready [12]	Sel	21.3
802	Sensor State: Not Available [12]	Sel	21.3
803	Sensor State: No Data [12]	Sel	21.3
804	Sensor State: Initializing [12]	Sel	21.3
805	Sensor State: Access Denied [12]	Sel	21.3
806	Sensor State: Error [12]	Sel	21.3
807-80F	<i>Reserved</i>		
810	Sensor Event: Unknown [12]	Sel	21.4
811	Sensor Event: State Changed [12]	Sel	21.4
812	Sensor Event: Property Changed [12]	Sel	21.4
813	Sensor Event: Data Updated [12]	Sel	21.4
814	Sensor Event: Poll Response [12]	Sel	21.4
815	Sensor Event: Change Sensitivity [12]	Sel	21.4
816	Sensor Event: Range Maximum Reached [12]	Sel	21.4
817	Sensor Event: Range Minimum Reached [12]	Sel	21.4
818	Sensor Event: High Threshold Cross Upward [12]	Sel	21.4



819	Sensor Event: High Threshold Cross Downward [12]	Sel	21.4
81A	Sensor Event: Low Threshold Cross Upward [12]	Sel	21.4
81B	Sensor Event: Low Threshold Cross Downward [12]	Sel	21.4
81C	Sensor Event: Zero Threshold Cross Upward [12]	Sel	21.4
81D	Sensor Event: Zero Threshold Cross Downward [12]	Sel	21.4
81E	Sensor Event: Period Exceeded [12]	Sel	21.4
81F	Sensor Event: Frequency Exceeded [12]	Sel	21.4
820	Sensor Event: Complex Trigger [12]	Sel	21.4
821-82F	<i>Reserved</i>		
830	Connection Type: PC Integrated [12]	Sel	21.5.1
831	Connection Type: PC Attached [12]	Sel	21.5.1
832	Connection Type: PC External [12]	Sel	21.5.1
833-83F	<i>Reserved</i>		
840	Reporting State: Report No Events [12]	Sel	21.5.2
841	Reporting State: Report All Events [12]	Sel	21.5.2
842	Reporting State: Report Threshold Events [12]	Sel	21.5.2
843	Reporting State: Wake On No Events [12]	Sel	21.5.2
844	Reporting State: Wake On All Events [12]	Sel	21.5.2
845	Reporting State: Wake On Threshold Events [12]	Sel	21.5.2
846-84F	<i>Reserved</i>		
850	Power State: Undefined [12]	Sel	21.5.3
851	Power State: D0 Full Power [12]	Sel	21.5.3
852	Power State: D1 Low Power [12]	Sel	21.5.3
853	Power State: D2 Standby Power with Wakeup [12]	Sel	21.5.3
854	Power State: D3 Sleep with Wakeup [12]	Sel	21.5.3
855	Power State: D4 Power Off [12]	Sel	21.5.3
856-86F	<i>Reserved</i>		
870	Fix Quality: No Fix [12]	Sel	21.10.2
871	Fix Quality: GPS [12]	Sel	21.10.2
872	Fix Quality: DGPS [12]	Sel	21.10.2
873-87F	<i>Reserved</i>		
880	Fix Type: No Fix [12]	Sel	21.10.3
881	Fix Type: GPS SPS Mode, Fix Valid [12]	Sel	21.10.3
882	Fix Type: DGPS SPS Mode, Fix Valid [12]	Sel	21.10.3
883	Fix Type: GPS PPS Mode, Fix Valid [12]	Sel	21.10.3
884	Fix Type: Real Time Kinematic [12]	Sel	21.10.3
885	Fix Type: Float RTK [12]	Sel	21.10.3
886	Fix Type: Estimated (dead reckoned) [12]	Sel	21.10.3
887	Fix Type: Manual Input Mode [12]	Sel	21.10.3

888	Fix Type: Simulator Mode [12]	Sel	21.10.3
889-88F	<i>Reserved</i>		
890	GPS Operation Mode: Manual [12]	Sel	21.10.4
891	GPS Operation Mode: Automatic [12]	Sel	21.10.4
892-89F	<i>Reserved</i>		
8A0	GPS Selection Mode: Autonomous [12]	Sel	21.10.5
8A1	GPS Selection Mode: DGPS [12]	Sel	21.10.5
8A2	GPS Selection Mode: Estimated (dead reckoned) [12]	Sel	21.10.5
8A3	GPS Selection Mode: Manual Input [12]	Sel	21.10.5
8A4	GPS Selection Mode: Simulator [12]	Sel	21.10.5
8A5	GPS Selection Mode: Data Not Valid [12]	Sel	21.10.5
8A6-8AF	<i>Reserved</i>		
8B0	GPS Status Data: Valid [12]	Sel	21.10.6
8B1	GPS Status Data: Not Valid [12]	Sel	21.10.6
8B2-85F	<i>Reserved</i>		
860	Accuracy: Default [12]	Sel	21.10.1
861	Accuracy: High [12]	Sel	21.10.1
862	Accuracy: Medium [12]	Sel	21.10.1
863	Accuracy: Low [12]	Sel	21.10.1
864-8BF	<i>Reserved</i>		
8C0	Day of Week: Sunday [12]	Sel	21.15.1
8C1	Day of Week: Monday [12]	Sel	21.15.1
8C2	Day of Week: Tuesday [12]	Sel	21.15.1
8C3	Day of Week: Wednesday [12]	Sel	21.15.1
8C4	Day of Week: Thursday [12]	Sel	21.15.1
8C5	Day of Week: Friday [12]	Sel	21.15.1
8C6	Day of Week: Saturday [12]	Sel	21.15.1
8C7-8CF	<i>Reserved</i>		
8D0	Kind: Category [12]	Sel	21.18.1
8D1	Kind: Type [12]	Sel	21.18.1
8D2	Kind: Event [12]	Sel	21.18.1
8D3	Kind: Property [12]	Sel	21.18.1
8D4	Kind: Data Field [12]	Sel	21.18.1
8D5-8DF	<i>Reserved</i>		
8E0	Magnetometer Accuracy: Low [12]	Sel	21.13.1
8E1	Magnetometer Accuracy: Medium [12]	Sel	21.13.1
8E2	Magnetometer Accuracy: High [12]	Sel	21.13.1
8E3-8EF	<i>Reserved</i>		
8F0	Simple Orientation Direction: Not Rotated [30]	Sel	21.13.2
8F1	Simple Orientation Direction: Rotated 90 Degrees CCW [30]	Sel	21.13.2

8F2	Simple Orientation Direction: Rotated 180 Degrees CCW [30]	Sel	21.13.2
8F3	Simple Orientation Direction: Rotated 270 Degrees CCW [30]	Sel	21.13.2
8F4	Simple Orientation Direction: Face Up [30]	Sel	21.13.2
8F5	Simple Orientation Direction: Face Down [30]	Sel	21.13.2
8F6-8FF	<i>Reserved</i>		
900	VT_NULL [12]	Sel	21.18.2
901	VT_BOOL [12]	Sel	21.18.2
902	VT_UI1 [12]	Sel	21.18.2
903	VT_I1 [12]	Sel	21.18.2
904	VT_UI2 [12]	Sel	21.18.2
905	VT_I2 [12]	Sel	21.18.2
906	VT_UI4 [12]	Sel	21.18.2
907	VT_I4 [12]	Sel	21.18.2
908	VT_UI8 [12]	Sel	21.18.2
909	VT_I8 [12]	Sel	21.18.2
90A	VT_R4 [12]	Sel	21.18.2
90B	VT_R8 [12]	Sel	21.18.2
90C	VT_WSTR [12]	Sel	21.18.2
90D	VT_STR [12]	Sel	21.18.2
90E	VT_CLSID [12]	Sel	21.18.2
90F	VT_VECTOR VT_UI1 [12]	Sel	21.18.2
910	VT_F16E0 [12]	Sel	21.18.2
911	VT_F16E1 [12]	Sel	21.18.2
912	VT_F16E2 [12]	Sel	21.18.2
913	VT_F16E3 [12]	Sel	21.18.2
914	VT_F16E4 [12]	Sel	21.18.2
915	VT_F16E5 [12]	Sel	21.18.2
916	VT_F16E6 [12]	Sel	21.18.2
917	VT_F16E7 [12]	Sel	21.18.2
918	VT_F16E8 [12]	Sel	21.18.2
919	VT_F16E9 [12]	Sel	21.18.2
91A	VT_F16EA [12]	Sel	21.18.2
91B	VT_F16EB [12]	Sel	21.18.2
91C	VT_F16EC [12]	Sel	21.18.2
91D	VT_F16ED [12]	Sel	21.18.2
91E	VT_F16EE [12]	Sel	21.18.2
91F	VT_F16EF [12]	Sel	21.18.2
920	VT_F32E0 [12]	Sel	21.18.2
921	VT_F32E1 [12]	Sel	21.18.2

922	VT_F32E2 [12]	Sel	21.18.2
923	VT_F32E3 [12]	Sel	21.18.2
924	VT_F32E4 [12]	Sel	21.18.2
925	VT_F32E5 [12]	Sel	21.18.2
926	VT_F32E6 [12]	Sel	21.18.2
927	VT_F32E7 [12]	Sel	21.18.2
928	VT_F32E8 [12]	Sel	21.18.2
929	VT_F32E9 [12]	Sel	21.18.2
92A	VT_F32EA [12]	Sel	21.18.2
92B	VT_F32EB [12]	Sel	21.18.2
92C	VT_F32EC [12]	Sel	21.18.2
92D	VT_F32ED [12]	Sel	21.18.2
92E	VT_F32EE [12]	Sel	21.18.2
92F	VT_F32EF [12]	Sel	21.18.2
930	Activity Type: Unknown [30]	Sel	21.19.1
931	Activity Type: Stationary [30]	Sel	21.19.1
932	Activity Type: Fidgeting [30]	Sel	21.19.1
933	Activity Type: Walking [30]	Sel	21.19.1
934	Activity Type: Running [30]	Sel	21.19.1
935	Activity Type: In Vehicle [30]	Sel	21.19.1
936	Activity Type: Biking [30]	Sel	21.19.1
937	Activity Type: Idle [30]	Sel	21.19.1
938-93F	<i>Reserved</i>		
940	Unit: Not Specified [12]	Sel	21.18.3
941	Unit: Lux [12]	Sel	21.18.3
942	Unit: Degrees Kelvin [12]	Sel	21.18.3
943	Unit: Degrees Celsius [12]	Sel	21.18.3
944	Unit: Pascal [12]	Sel	21.18.3
945	Unit: Newton [12]	Sel	21.18.3
946	Unit: Meters/Second [12]	Sel	21.18.3
947	Unit: Kilogram [12]	Sel	21.18.3
948	Unit: Meter [12]	Sel	21.18.3
949	Unit: Meters/Second/Second [12]	Sel	21.18.3
94A	Unit: Farad [12]	Sel	21.18.3
94B	Unit: Ampere [12]	Sel	21.18.3
94C	Unit: Watt [12]	Sel	21.18.3
94D	Unit: Henry [12]	Sel	21.18.3
94E	Unit: Ohm [12]	Sel	21.18.3
94F	Unit: Volt [12]	Sel	21.18.3

950	Unit: Hertz [12]	Sel	21.18.3
951	Unit: Bar [12]	Sel	21.18.3
952	Unit: Degrees Anti-clockwise [12]	Sel	21.18.3
953	Unit: Degrees Clockwise [12]	Sel	21.18.3
954	Unit: Degrees [12]	Sel	21.18.3
955	Unit: Degrees/Second [12]	Sel	21.18.3
956	Unit: Degrees/Second/Second [12]	Sel	21.18.3
957	Unit: Knot [12]	Sel	21.18.3
958	Unit: Percent [12]	Sel	21.18.3
959	Unit: Second [12]	Sel	21.18.3
95A	Unit: Millisecond [12]	Sel	21.18.3
95B	Unit: G [12]	Sel	21.18.3
95C	Unit: Bytes [12]	Sel	21.18.3
95D	Unit: Milligauss [12]	Sel	21.18.3
95E	Unit: Bits [12]	Sel	21.18.3
95F-95F	<i>Reserved</i>		
960	Activity State: No State Change [30]	Sel	21.19.2
961	Activity State: Start Activity [30]	Sel	21.19.2
962	Activity State: End Activity [30]	Sel	21.19.2
963-96F	<i>Reserved</i>		
970	Exponent 0 [12]	Sel	21.18.4
971	Exponent 1 [12]	Sel	21.18.4
972	Exponent 2 [12]	Sel	21.18.4
973	Exponent 3 [12]	Sel	21.18.4
974	Exponent 4 [12]	Sel	21.18.4
975	Exponent 5 [12]	Sel	21.18.4
976	Exponent 6 [12]	Sel	21.18.4
977	Exponent 7 [12]	Sel	21.18.4
978	Exponent 8 [12]	Sel	21.18.4
979	Exponent 9 [12]	Sel	21.18.4
97A	Exponent A [12]	Sel	21.18.4
97B	Exponent B [12]	Sel	21.18.4
97C	Exponent C [12]	Sel	21.18.4
97D	Exponent D [12]	Sel	21.18.4
97E	Exponent E [12]	Sel	21.18.4
97F	Exponent F [12]	Sel	21.18.4
980	Device Position: Unknown [30]	Sel	21.19.3
981	Device Position: Unchanged [30]	Sel	21.19.3
982	Device Position: On Desk [30]	Sel	21.19.3

983	Device Position: In Hand [30]	Sel	21.19.3
984	Device Position: Moving in Bag [30]	Sel	21.19.3
985	Device Position: Stationary in Bag [30]	Sel	21.19.3
986-98F	<i>Reserved</i>		
990	Step Type: Unknown [30]	Sel	21.19.4
991	Step Type: Running [30]	Sel	21.19.4
992	Step Type: Walking [30]	Sel	21.19.4
993-99F	<i>Reserved</i>		
9A0	Gesture State: Unknown [60]	Sel	21.20.2.4
9A1	Gesture State: Started [60]	Sel	21.20.2.4
9A2	Gesture State: Completed [60]	Sel	21.20.2.4
9A3	Gesture State: Cancelled [60]	Sel	21.20.2.4
9A4-9AF	<i>Reserved</i>		
9B0	Hinge Fold Contributing Panel: Unknown [60]	Sel	21.20.2.5
9B1	Hinge Fold Contributing Panel: Panel 1 [60]	Sel	21.20.2.5
9B2	Hinge Fold Contributing Panel: Panel 2 [60]	Sel	21.20.2.5
9B3	Hinge Fold Contributing Panel: Both [60]	Sel	21.20.2.5
9B4	Hinge Fold Type: Unknown [60]	Sel	21.20.2.6
9B5	Hinge Fold Type: Increasing [60]	Sel	21.20.2.6
9B6	Hinge Fold Type: Decreasing [60]	Sel	21.20.2.6
9B7-FFF	<i>Reserved</i>		
1000	Modifier: Change Sensitivity Absolute [12]	US	21.2
1001-10FF	<i>Reserved</i>		
1100-17FF	<i>Reserved for use as Change Sensitivity Absolute modifier range</i>		
1800-1FFF	<i>Reserved</i>		
2000	Modifier: Maximum [12]	US	21.2
2001-20FF	<i>Reserved</i>		
2100-27FF	<i>Reserved for use as Maximum modifier range</i>		
2800-2FFF	<i>Reserved</i>		
3000	Modifier: Minimum [12]	US	21.2
3001-30FF	<i>Reserved</i>		
3100-37FF	<i>Reserved for use as Minimum modifier range</i>		
3800-3FFF	<i>Reserved</i>		
4000	Modifier: Accuracy [12]	US	21.2
4001-40FF	<i>Reserved</i>		
4100-47FF	<i>Reserved for use as Accuracy modifier range</i>		
4800-4FFF	<i>Reserved</i>		
5000	Modifier: Resolution [12]	US	21.2
5001-50FF	<i>Reserved</i>		
5100-57FF	<i>Reserved for use as Resolution modifier range</i>		
5800-5FFF	<i>Reserved</i>		

6000	Modifier: Threshold High [12]	US	21.2
6001-60FF	<i>Reserved</i>		
6100-67FF	<i>Reserved for use as Threshold High modifier range</i>		
6800-6FFF	<i>Reserved</i>		
7000	Modifier: Threshold Low [12]	US	21.2
7001-70FF	<i>Reserved</i>		
7100-77FF	<i>Reserved for use as Threshold Low modifier range</i>		
7800-7FFF	<i>Reserved</i>		
8000	Modifier: Calibration Offset [12]	US	21.2
8001-80FF	<i>Reserved</i>		
8100-87FF	<i>Reserved for use as Calibration Offset modifier range</i>		
8800-8FFF	<i>Reserved</i>		
9000	Modifier: Calibration Multiplier [12]	US	21.2
9001-90FF	<i>Reserved</i>		
9100-97FF	<i>Reserved for use as Calibration Multiplier modifier range</i>		
9800-9FFF	<i>Reserved</i>		
A000	Modifier: Report Interval [12]	US	21.2
A001-A0FF	<i>Reserved</i>		
A100-A7FF	<i>Reserved for use as Report Interval modifier range</i>		
A800-AFFF	<i>Reserved</i>		
B000	Modifier: Frequency Max [12]	US	21.2
B001-B0FF	<i>Reserved</i>		
B100-B7FF	<i>Reserved for use as Frequency Max modifier range</i>		
B800-BFFF	<i>Reserved</i>		
C000	Modifier: Period Max [12]	US	21.2
C001-C0FF	<i>Reserved</i>		
C100-C7FF	<i>Reserved for use as Period Max modifier range</i>		
C800-CFFF	<i>Reserved</i>		
D000	Modifier: Change Sensitivity Percent of Range [12]	US	21.2
D001-D0FF	<i>Reserved</i>		
D100-D7FF	<i>Reserved for use as Change Sensitivity Percent modifier range</i>		
D800-DFFF	<i>Reserved</i>		
E000	Modifier: Change Sensitivity Percent Relative [12]	US	21.2
E001-E0FF	<i>Reserved</i>		
E100-E7FF	<i>Reserved for use as Change Sensitivity Percent modifier range</i>		
E800-EFFF	<i>Reserved</i>		
F000	Modifier: Vendor Reserved [12]	US	21.2
F001-F0FF	<i>Reserved</i>		
F100-F7FF	<i>Reserved for use as Vendor Reserved modifier range</i>		
F800-FFFF	<i>Reserved</i>		

Table 21.1: Sensors Page

## 21.1 Sensor Device Usages

Usage Name	Usage Type	Description
<b>Sensor</b>	CA/CP	An application-level or physical collection that identifies a device that aggregates one or more sensors on one sensor board; for example, a sensor hub.
<b>Biometric</b>	CA/CP	An application-level or physical collection that identifies a device that detects biometric information.
<b>Biometric: Blood Pressure</b>	CA/CP	An application-level or physical collection that identifies a device that measures the systolic/diastolic blood pressure of the device user.
<b>Biometric: Body Temperature</b>	CA/CP	An application-level or physical collection that identifies a device that measures temperature where the temperature source is a location on the device user's body.
<b>Biometric: Heart Rate</b>	CA/CP	An application-level or physical collection that identifies a device that measures the heart rate of the device user.
<b>Biometric: Heart Rate Variability</b>	CA/CP	An application-level or physical collection that identifies a device that measures the variation in the time interval between heartbeats of the device user.
<b>Biometric: Human Presence</b>	CA/CP	An application-level or physical collection that identifies a device that detects human presence (Boolean yes or no).
<b>Biometric: Human Proximity</b>	CA/CP	An application-level or physical collection that identifies a device that detects human proximity (range of values).
<b>Biometric: Human Touch</b>	CA/CP	An application-level or physical collection that identifies a device that registers human touch. <i>This is not to be confused with single-touch or multi-touch digitizers that provide finger position coordinates.</i>
<b>Biometric: Peripheral Oxygen Saturation</b>	CA/CP	An application-level or physical collection that identifies a device that measures the peripheral oxygen saturation (SpO2) as a percentage of the hemoglobin in the device user's blood which contains oxygen.
<b>Biometric: Respiratory Rate</b>	CA/CP	An application-level or physical collection that identifies a device that measures the respiratory rate (number of breaths taken over time) of the device user.
<b>Electrical</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical information.
<b>Electrical: Capacitance</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical capacitance.
<b>Electrical: Current</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical current, such as an ammeter.
<b>Electrical: Frequency</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical frequency, such as a frequency meter.
<b>Electrical: Period</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical period, such as a period meter.
<b>Electrical: Potentiometer</b>	CA/CP	An application-level or physical collection that identifies a device that measures percent of range, such as a potentiometer.
<b>Electrical: Power</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical power, such as a wattmeter.



<b>Electrical: Inductance</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical inductance.
<b>Electrical: Resistance</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical resistance, such as an ohmmeter or a potentiometer.
<b>Electrical: Voltage</b>	CA/CP	An application-level or physical collection that identifies a device that measures electrical voltage, such as a voltmeter.
<b>Environmental</b>	CA/CP	An application-level or physical collection that identifies a device that measures environmental information.
<b>Environmental: Air Quality</b>	CA/CP	An application-level or physical collection that identifies a device that measures the amount of pollutants in the air.
<b>Environmental: Atmospheric Pressure</b>	CA/CP	An application-level or physical collection that identifies a device that measures atmospheric pressure, such as a barometer.
<b>Environmental: Heat Index</b>	CA/CP	An application-level or physical collection that identifies a device that measures the human-perceived temperature based on the current humidity and air temperature levels.
<b>Environmental; Humidity</b>	CA/CP	An application-level or physical collection that identifies a device that measures humidity, such as a hygrometer.
<b>Environmental: Object Presence</b>	CA/CP	An application-level of physical collection that identifies a device that detects object presence (Boolean yes or no).
<b>Environmental: Object Proximity</b>	CA/CP	An application-level or physical collection that identifies a device that detects object proximity (range of values).
<b>Environmental: Surface Temperature</b>	CA/CP	An application-level or physical collection that identifies a device that measures the temperature of a surface which the device is currently in contact with.
<b>Environmental: Temperature</b>	CA/CP	An application-level or physical collection that identifies a device that measures temperature, such as a thermometer or a thermocouple. This sensor's temperature source primarily is the ambient air (see Biometric: Body Temperature and Environmental: Surface Temperature for other temperature sensor types).
<b>Environmental: Volatile Organic Compounds</b>	CA/CP	An application-level or physical collection that identifies a device that measures the amount of volatile organic compounds in the air.
<b>Environmental: Wind Direction</b>	CA/CP	An application-level or physical collection that identifies a device that measures wind direction, such as a weather vane.
<b>Environmental: Wind Speed</b>	CA/CP	An application-level or physical collection that identifies a device that measures wind speed, such as an anemometer.
<b>Gesture</b>	CA/CP	An application-level of physical collection that identifies a sensor that can detect system physical manipulation gesture by an external agent.
<b>Gesture: Chassis Flip Gesture</b>	CA/CP	An application-level or physical collection that identifies a sensor that can detect chassis flip gesture of a system. see <a href="#">Section 21.20.2.1 Chassis Flip Gesture</a>
<b>Gesture: Hinge Fold Gesture</b>	CA/CP	An application-level or physical collection that identifies a sensor that can detect a hinge fold gesture. see <a href="#">Section 21.20.2.2 Hinge Fold Gesture</a>
<b>Light</b>	CA/CP	An application-level or physical collection that identifies a device that measures light information.

<b>Light: Ambient Light</b>	CA/CP	An application-level or physical collection that identifies a device that detects ambient light.
<b>Light: Consumer Infrared</b>	CA/CP	An application-level or physical collection that identifies a device that can transmit and receive Consumer Infrared signals, e.g., for controlling TVs and stereo equipment.
<b>Light: Infrared Light</b>	CA/CP	An application-level or physical collection that identifies a device that measures levels of infrared light (wavelengths of approximately 700nm to 1mm on the electromagnetic spectrum).
<b>Light: Visible Light</b>	CA/CP	An application-level or physical collection that identifies a device that measures levels of visible light (wavelengths of approximately 390nm to 700nm on the electromagnetic spectrum).
<b>Light: Ultraviolet Light</b>	CA/CP	An application-level or physical collection that identifies a device that measures levels of Ultraviolet light (wavelengths of approximately 10nm to 390nm on the electromagnetic spectrum).
<b>Location</b>	CA/CP	An application-level or physical collection that identifies a device that can report location information.
<b>Location: Broadcast</b>	CA/CP	An application-level or physical collection that identifies a device that detect location information using transmissions such as television or radio frequencies (for example, cellular telephone).
<b>Location: Dead Reckoning</b>	CA/CP	An application-level or physical collection that identifies a virtual device that calculates the current location using aggregated motion data from multiple physical sensors (such as GPS, accelerometer, gyro, compass, altimeter).
<b>Location: GPS (Global Positioning System)</b>	CA/CP	An application-level or physical collection that identifies a device that detects the current location using the GPS (Global Positioning Satellite) system.
<b>Location: Lookup</b>	CA/CP	An application-level or physical collection that identifies a device that detects the current location using the computers current IP Address.
<b>Location: Other</b>	CA/CP	An application-level or physical collection that identifies a device that detects the current location using other means.
<b>Location: Static</b>	CA/CP	An application-level or physical collection that identifies a device that use end-user provided information such as Civic Address to report the current location.
<b>Location: Triangulation</b>	CA/CP	An application-level or physical collection that identifies a device that detects the current location using triangulation techniques, such as cellular phone tower proximities.
<b>Mechanical</b>	CA/CP	An application-level or physical collection that identifies a device that can report mechanical information.
<b>Mechanical: Boolean Switch</b>	CA/CP	An application-level or physical collection that identifies a device that can switch between two states: on and off.
<b>Mechanical: Boolean Switch Array</b>	CA/CP	An application-level or physical collection that identifies an array of devices each of which can switch between two states: on and off.
<b>Mechanical: Multivalued Switch</b>	CA/CP	An application-level or physical collection that identifies a device that can switch between multiple states.
<b>Mechanical: Force</b>	CA/CP	An application-level or physical collection that identifies a device that measures force.

<b>Mechanical: Pressure</b>	CA/CP	An application-level or physical collection that identifies a device that measures pressure.
<b>Mechanical: Strain</b>	CA/CP	An application-level or physical collection that identifies a device that measures strain.
<b>Mechanical: Weight</b>	CA/CP	An application-level or physical collection that identifies a device that measures weight.
<b>Mechanical: Haptic Vibrator</b>	CA/CP	An application-level or physical collection that identifies a vibrator device that can provide Haptic feedback.
<b>Mechanical: Hall Effect Switch</b>	CA/CP	An application-level or physical collection that identifies a Hall Effect (magnetic proximity) detector switch.
<b>Motion</b>	CA/CP	An application-level or physical collection that identifies a device that measures motion information.
<b>Motion: Accelerometer 1D</b>	CA/CP	An application-level or physical collection that identifies a device that measures acceleration along 1 axis.
<b>Motion: Accelerometer 2D</b>	CA/CP	An application-level or physical collection that identifies a device that measures acceleration along 2 axes.
<b>Motion: Accelerometer 3D</b>	CA/CP	An application-level or physical collection that identifies a device that measures acceleration along 3 axes.
<b>Motion: Gyrometer 1D</b>	CA/CP	An application-level or physical collection that identifies a device that measures angular acceleration or velocity about 1 axis.
<b>Motion: Gyrometer 2D</b>	CA/CP	An application-level or physical collection that identifies a device that measures angular acceleration or velocity about 2 axes.
<b>Motion: Gyrometer 3D</b>	CA/CP	An application-level or physical collection that identifies a device that measures angular acceleration or velocity about 3 axes.
<b>Motion: Motion Detector</b>	CA/CP	An application-level or physical collection that identifies a device that detects motion (Boolean yes or no).
<b>Motion: Speedometer</b>	CA/CP	An application-level or physical collection that identifies a device that measures velocity.
<b>Motion: Accelerometer</b>	CA/CP	An application-level or physical collection that identifies a device that measures acceleration along any number of axes.
<b>Motion: Gravity Vector</b>	CA/CP	An application-level or physical collection that identifies a device that measures exclusively the force of Earth's gravity along any number of axes.
<b>Motion: Linear Accelerometer</b>	CA/CP	An application-level or physical collection that identifies a device that measures the linear acceleration (acceleration excluding the force of Earth's gravity) along any number of axes. Note that this differs from a standard accelerometer in that at rest, a standard accelerometer displays 1g due to earth's gravitational pull while a linear accelerometer will show 0g.
<b>Motion: Gyrometer</b>	CA/CP	An application-level or physical collection that identifies a device that measures angular acceleration or velocity about any number of axes.
<b>Orientation</b>	CA/CP	An application-level or physical collection that identifies a device that measures orientation information.
<b>Orientation: Compass 1D</b>	CA/CP	An application-level or physical collection that identifies a one-axis compass.
<b>Orientation: Compass 2D</b>	CA/CP	An application-level or physical collection that identifies a two-axis compass.

<b>Orientation: Compass 3D</b>	CA/CP	An application-level or physical collection that identifies a three-axis compass.
<b>Orientation: Inclinometer 1D</b>	CA/CP	An application-level or physical collection that identifies a one-axis tilt meter.
<b>Orientation: Inclinometer 2D</b>	CA/CP	An application-level or physical collection that identifies a two-axis tilt meter.
<b>Orientation: Inclinometer 3D</b>	CA/CP	An application-level or physical collection that identifies a three-axis tilt meter.
<b>Orientation: Distance 1D</b>	CA/CP	An application-level or physical collection that identifies a device that measures distance using one axis.
<b>Orientation: Distance 2D</b>	CA/CP	An application-level or physical collection that identifies a device that measures distance using two axes.
<b>Orientation: Distance 3D</b>	CA/CP	An application-level or physical collection that identifies a device that measures distance using three axes.
<b>Orientation: Device Orientation</b>	CA/CP	An application-level or physical collection that identifies a device that measures device orientation in three axes (typically through the combined use of an accelerometer and gyroscope).
<b>Orientation: Compass</b>	CA/CP	An application-level or physical collection that identifies a compass with any number of axes.
<b>Orientation: Inclinometer</b>	CA/CP	An application-level or physical collection that identifies a tilt meter with any number of axes.
<b>Orientation: Distance</b>	CA/CP	An application-level or physical collection that identifies a device that measures distance using any number of axes.
<b>Orientation: Relative Orientation</b>	CA/CP	An application-level or physical collection that identifies a device that measures device orientation where yaw values are relative to the starting position of the device when powered on.
<b>Orientation: Simple Orientation</b>	CA/CP	An application-level or physical collection that identifies a device that measures the orientation by assigning an enumerated type to represent the current positional rotation of the face of the device.
<b>Orientation: Extended: Geomagnetic Orientation</b>	CA/CP	An application-level or physical collection that identifies a device that measures device orientation in three axes where yaw is relative to Earth's magnetic North (as opposed to true North). Note that this sensor normally is implemented through use of only an accelerometer and magnetometer, no gyroscope.
<b>Orientation: Extended: Magnetometer</b>	CA/CP	An application-level or physical collection that identifies a device that measures magnetic field strengths.
<b>Other</b>	CA/CP	An application-level or physical collection that identifies a device that does not fit into any of the other pre-defined categories.
<b>Other: Custom</b>	CA/CP	An application-level or physical collection that identifies a device that conforms to the <i>custom</i> sensor specification.
<b>Other: Generic</b>	CA/CP	An application-level or physical collection that identifies a device that conforms to the <i>generic</i> sensor specification.
<b>Other: Generic Enumerator</b>	CA/CP	An application-level or physical collection that identifies a device that conforms to the <i>generic enumerator</i> specification.
<b>Other: Hinge Angle</b>	CA/CP	An application-level or physical collection that identifies a sensor that measures the hinge angle.

<b>Personal Activity</b>	CA/CP	An application-level or physical collection that identifies a device that measures information regarding personal, day-to-day activities a user experiences.
<b>Personal Activity: Activity Detection</b>	CA/CP	An application-level or physical collection that identifies a device that measures confidence levels for detecting the device user's current activity.
<b>Personal Activity: Device Position</b>	CA/CP	An application-level or physical collection that identifies a device that detects the type of position in which the device is currently placed.
<b>Personal Activity: Pedometer</b>	CA/CP	An application-level or physical collection that identifies a device that measures the cumulative number of steps taken, category of steps taken, and length of time spent stepping per category by the device user.
<b>Personal Activity: Step Detection</b>	CA/CP	An application-level or physical collection that identifies a device that detects when the user has taken a step.
<b>Scanner</b>	CA/CP	An application-level or physical collection that identifies a device that reports information from scanning devices.
<b>Scanner: Barcode</b>	CA/CP	An application-level or physical collection that identifies a device that is used for optical scanning of bar codes. It is strongly recommended that barcode scanners report input data and symbology information using the defined <i>HID Point of Sale Usage Tables</i> specification and its associated HID Usage Page 0x8C.
<b>Scanner: RFID</b>	CA/CP	An application-level or physical collection that identifies a device that is used for radio-frequency scanning of tags.
<b>Scanner: NFC</b>	CA/CP	An application-level or physical collection that identifies a Near-Field Communication reader device. Such a device can communicate with other NFC-enabled devices over short distances. Some NFC devices are also able to read RFID tags.
<b>Time</b>	CA/CP	An application-level or physical collection that identifies a device that can report time, such as a typical RTC (Real Time Clock) / Time of Day Clock.
<b>Time: Alarm Timer</b>	CA/CP	An application-level or physical collection that identifies a device that can report information at a particular time or after a certain amount of time has passed.
<b>Time: Real Time Clock</b>	CA/CP	An application-level or physical collection that identifies a device that can report current time, most often used for timestamping sensor samples.
<b>Vendor Reserved 1</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 2</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 3</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 4</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 5</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 6</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 7</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 8</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 9</b>	CA/CP	Reserved for use by Vendors/OEMs

<b>Vendor Reserved 10</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 11</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 12</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 13</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 14</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 15</b>	CA/CP	Reserved for use by Vendors/OEMs
<b>Vendor Reserved 16</b>	CA/CP	Reserved for use by Vendors/OEMs

## 21.2 Modifiers

Modifiers are Usage Switches (US) used in conjunction other Usages and are used to change the meaning of a data field. These fields are optionally supported by all sensors. The meaning is common for all sensors. This permits a single data field to take on some number of additional meanings depending on the Usage Id of that data field.

The value of the Modifier is OR-ed into the top 4 bits of the un-modified Usage Id. Base Data Field Usage Ids (0x0100-0x07FF) can be modified with the application of a modifier to become Usage Ids (0x1100-0xF7FF). Usage Ids stemmed from combining modifiers with non-data field usages are considered reserved.

The modifier is used to change the meaning of a data field as follows:

Usage Name	Usage Type	Top Bits	Description
Modifier: None	US	0	The information contained in the data field is the unmodified meaning for that data field.
Modifier: Change Sensitivity Absolute	US	1	Specifies the change sensitivity set for a particular data field. Units are the same as the data field being modified. For example, if the data field is <i>Temperature, Degrees Celsius</i> , and the absolute sensitivity is 3 then that would mean <i>change of <math>\pm 3</math> Degrees Celsius</i> .
Modifier: Maximum	US	2	The information contained in the data field is the maximum value for that data field.
Modifier: Minimum	US	3	The information contained in the data field is the minimum value for that data field.
Modifier: Accuracy	US	4	The information contained in the data field specifies the absolute accuracy with which that data field is reported.
Modifier: Resolution	US	5	The information contained in the data field specifies the absolute precision with which that data field is reported.
Modifier: Threshold High	US	6	The information contained in the data field is the high threshold value for that data field.
Modifier: Threshold Low	US	7	The information contained in the data field is the low threshold value for that data field.
Modifier: Calibration Offset	US	8	The information contained in the data field specifies the calibration offset applied to the data normally reported in that data field.
Modifier: Calibration Multiplier	US	9	The information contained in the data field specifies the calibration multiplier applied to the data normally reported in that data field.
Modifier: Report Interval	US	A	Specifies the Report Interval set for a particular data field.
Modifier: Frequency Max	US	B	Specifies the maximum frequency for a particular data field. Usually used as a time oriented threshold to indicate an event has occurred more often than required.
Modifier: Period Max	US	C	Specifies the maximum period for a particular data field. Usually used as a maximum threshold to indicate an event has not occurred.

Modifier: Change Sensitivity Percent of Range	US	D	Specifies the change sensitivity set for a particular data field. Units are a percentage of the Minimum to Maximum range. For example, if the data field is <i>Temperature, Degrees Celsius</i> , the Minimum is -4.0, the Maximum is +40.0, and the percent of range sensitivity is 5 then that would mean <i>change of 5% of -4.0 to +40.0 Degrees Celsius</i> , (i.e., $\pm 2.2$ Degrees Celsius).
Modifier: Change Sensitivity Percent Relative	US	E	Specifies the change sensitivity set for a particular data field. Units are a percentage of the <i>prior reading</i> . For example, if the data field is <i>Temperature, Degrees Celsius</i> , the prior reading was +24.0, and the percent relative sensitivity is 4 then that would mean <i>change of 4% from 24.0 Degrees Celsius</i> , (i.e., $\pm 0.96$ Degrees Celsius).
Modifier: Vendor Reserved	US	F	Reserved for use by Vendors as a Vendor specific Modifier.



## 21.3 Sensor State Event Usages

Usage Name	Usage Type	Description
Event	DV	Generic event for sensor. Vendor defined.

These fields are optionally supported by all sensors. The meaning is common for all sensors.

The Event: Sensor State field is usually part of the Input report Event and indicates the current state of the sensor.

Usage Name	Usage Type	Description
<b>Event: Sensor State</b>	NARY	Specifies the a sensor state (from below).
Sensor State: Undefined	Sel	The sensor state is not known
Sensor State: Ready	Sel	Sensor is able to provide new complete and accurate data.
Sensor State: Not Available	Sel	The sensor not available.
Sensor State: No Data	Sel	The sensor is available, but is not yet providing data. It is not known in what timeframe data will, if ever, be provided.
Sensor State: Initializing	Sel	The sensor is available, but is not yet providing data due to initialization activities. It is expected the sensor will provide data, but the timeframe in which that data will be available is not know.
Sensor State: Access Denied	Sel	In the case where an ID must be provided to access sensor data, and the requester fails to match the ID, this state will be returned.
Sensor State: Error	Sel	The sensor has encountered a major error. The sensor may recover from the state, but the time frame for recovery is unknown.

## 21.4 Sensor Event Usages

These fields are optionally supported by all sensors. The meaning is common for all sensors.

The Event: Sensor Event field is usually part of the Input report Event and indicates the reason for the receipt of the input report.

Usage Name	Usage Type	Description
<b>Event: Sensor Event</b>	NAry	Specifies the a sensor event (from below).
Sensor Event: Unknown	Sel	The sensor event type is not known.
Sensor Event: State Changed	Sel	The sensor state has changed.
Sensor Event: Property Changed	Sel	A property value has changed.
Sensor Event: Data Updated	Sel	A data field has changed.
Sensor Event: Poll Response	Sel	The most current sensor data is being returned as the result of a poll request (Get Input).
Sensor Event: Change Sensitivity	Sel	The change sensitivity has been exceeded for a data field.
Sensor Event: Range Maximum Reached	Sel	The maximum for a data field has been reached.
Sensor Event: Range Minimum Reached	Sel	The minimum for a data field has been reached.
Sensor Event: High Threshold Cross Upward	Sel	The high threshold set for a data field has been crossed to above the threshold from below the threshold.
Sensor Event: High Threshold Cross Downward	Sel	The high threshold set for a data field has been crossed to below the threshold from above the threshold.
Sensor Event: Low Threshold Cross Upward	Sel	The low threshold set for a data field has been crossed to above the threshold from below the threshold.
Sensor Event: Low Threshold Cross Downward	Sel	The low threshold set for a data field has been crossed to below the threshold from above the threshold.
Sensor Event: Zero Threshold Cross Upward	Sel	The zero point for a data field has been crossed to above the zero point from at or below the zero point.
Sensor Event: Zero Threshold Cross Downward	Sel	The zero point for a data field has been touched from above the zero point.
Sensor Event: Period Exceeded	Sel	The maximum period set for a data field has been exceeded.
Sensor Event: Frequency Exceeded	Sel	The maximum frequency set for a data field has been exceeded.
Sensor Event: Complex Trigger	Sel	A complex combination of vendor-defined circumstances has occurred.

## 21.5 Generic Sensor Property Usages

These fields are optionally supported by all sensors. The meaning is common for all sensors.

Usage Name	Usage Type	Description
Property	DV	Generic property for sensor. Vendor defined.
Property: Friendly Name	SV	Specifies a textual string name of the device in a humanfriendly wording.
Property: Persistent Unique ID	DV	Uniquely identifies the device instance with which the sensor is associated. You can use this to tell apart multiple identical sensors attached to the same computer. Typically this value will be either dynamically stored by the operating system into the USB device shortly after reset/power-up or assigned by the manufacturer at the time the device is manufactured.
Property: Sensor Status	DV	Specifies the current sensor status, as defined by the implementer. Not to be confused with the Sensor State Data Field that has standardized enumeration values.
Property: Minimum Report Interval	SV	Specifies the minimum allowed elapsed time for periodic sensor Input Report generation. Default unit of measure is milliseconds; can be overridden using explicit Unit and/or Unit Exponent.
Property: Sensor Manufacturer	SV	Specifies a textual string name of the manufacturer of a sensor device. For USB-based sensor devices, this may be the same as the MANUFACTURER USB String Descriptor, but could differ in two cases: (1) when a vendor manufactures a sensor module that incorporates a sensor chip from a third-party manufacturer; or (2) when a vendor manufactures a sensor hub that contains an aggregation of sensors from one or more other manufacturers.
Property: Sensor Model	SV	Specifies a textual string name of the model of a sensor device. For USB-based sensor devices, this may be the same as the PRODUCT USB String Descriptor, but could differ in two cases: (1) when a vendor manufactures a sensor module that incorporates a sensor chip from a third-party manufacturer; or (2) when a vendor manufactures a sensor hub that contains an aggregation of sensors from one or more other manufacturers.
Property: Sensor Serial Number	SV	Specifies a textual string name of the Serial Number ID of a sensor device. For USB-based sensor devices, this may be the same as the SERIAL NUMBER USB String Descriptor, but could differ in two cases: (1) when a vendor manufactures a sensor module that incorporates a sensor chip from a third-party manufacturer; or (2) when a vendor manufactures a sensor hub that contains an aggregation of sensors from one or more other manufacturers.
Property: Sensor Description	SV	Specifies a textual string description of the sensor function.
Property: Sensor Device Path	DV	Uniquely identifies the device instance with which the sensor is associated. You can use this to tell apart multiple identical sensors attached to the same computer. Typically this value will be dynamically stored by the operating system into the USB device shortly after reset/power-up.
Property: Hardware Revision	SV	Specifies a textual string name of the hardware revision of a sensor device.
Property: Firmware Version	SV	Specifies a textual string name of the firmware version of a sensor device.
Property: Release Date	SV	Specifies a textual string name of the release date of a sensor device.

Property: Report Interval	DV	Specifies the elapsed time for periodic sensor Input Report generation, in milliseconds. A value of 0 means <i>set/use device default value</i> , not 0 milliseconds.
Property: Change Sensitivity Absolute	DV	Specifies the absolute amount that by which a data field should change before an event (such as an asynchronous Input Report) is generated. Absolute sensitivity values are expressed using the same units as the corresponding data field, unless otherwise documented. This form of change sensitivity usually applies to all related data fields rather than to individual data fields.
Property: Change Sensitivity Percent of Range	DV	Specifies the percent relative to the overall range of a data field that a data field should change before an event (such as an asynchronous Input Report) is generated. Percent of range Sensitivity values are expressed in percent of range, with range typically being the maximum value minus the minimum value of the data field when expressed as absolute values. This form of change sensitivity usually applies to all related data fields rather than to individual data fields.
Property: Change Sensitivity Percent Relative	DV	Specifies the percent relative to the current sensor absolute value of a data field that a data field should change before an event (such as an asynchronous Input Report) is generated. This form of change sensitivity usually applies to all related data fields rather than to individual data fields.
Property: Accuracy	DV	Specifies the accuracy of sensor values by representing possible variation from true values. Accuracy values are expressed using the same units as the corresponding data field, except when otherwise documented. This form of accuracy usually applies to all related data fields rather than to individual data fields.
Property: Resolution	DV	Resolution represents sensitivity to change in the data field. Resolution values are expressed by using the same units as the data field, except when otherwise documented.
Property: Maximum	DV	Specifies the maximum value that can be produced by the sensor. Range maximum is expressed using the same units as the corresponding data field unless otherwise documented. This form of Range Maximum usually applies to all related data fields rather than individual data fields.
Property: Minimum	DV	Specifies the minimum value that can be produced by the sensor. Range minimum is expressed using the same units as the corresponding data field unless otherwise documented. This form of Range Minimum usually applies to all related data fields rather than individual data fields.
Property: Sampling Rate	DV	Sampling rate indicates the rate at which the sensor is physically sampled. This is not necessarily the same as the rate at which samples are reported using asynchronous Input reports. Default unit of measure is milliseconds; can be overridden using explicit Unit and/or Unit Exponent.
Property: Response Curve	DV	Reports pairs of values that provide a mapping between value levels and desired output.
Property: Is Primary	DF	Used in multiple sensors of same type, operating system can use this property to tell whether this sensor is primary: TRUE if it is primary, otherwise FALSE.

### 21.5.1 Property: Sensor Connection Types

Usage Name	Usage Type	Description
<b>Property: Sensor Connection Type</b>	NARY	Specifies the current connection type
Connection Type: PC Integrated	Sel	Integrated inside the computer.
Connection Type: PC Attached	Sel	Attached to the computer through a peripheral device (e.g. with a special docking connector).
Connection Type: PC External	Sel	Connected by means of an external interface such as a network connection. USB HID sensor devices should usually be type 0 or type 1.

### 21.5.2 Property: Reporting State

Usage Name	Usage Type	Description
<b>Property: Reporting State</b>	NARY	Indicates the current reporting state of the sensor.
Reporting State: Report No Events	Sel	No asynchronous Input reports are sent.
Reporting State: Report All Events	Sel	All Input reports are sent without any filtering.
Reporting State: Report Threshold Events	Sel	Input reports are sent only when it exceeds a pre-programmed threshold.
Reporting State: Wake On No Events	Sel	No asynchronous Input reports are sent and a Wake On event is never performed.
Reporting State: Wake On All Events	Sel	All Input reports are sent without any filtering and a Wake On event is performed.
Reporting State: Wake On Threshold Events	Sel	Input reports are sent only when it exceeds a pre-programmed threshold and a Wake On event is performed.

### 21.5.3 Property: Power State

Usage Name	Usage Type	Description
<b>Property: Power State</b>	NARY	Indicates the current power state of the sensor.
Power State: Undefined	Sel	The device power state is currently unknown or undefined.
Power State: D0 Full Power	Sel	The device is in full power operation.
Power State: D1 Low Power	Sel	The device is in a low power operation mode.
Power State: D2 Standby Power with Wakeup	Sel	The device is at a standby power mode (e.g., halted and awaiting interrupts) and can be awakened.
Power State: D3 Sleep with Wakeup	Sel	The device is in a sleep mode and can be awakened.
Power State: D4 Power Off	Sel	The device is completely powered off and cannot be awakened.

## 21.5.4 Property: Sensor Batching Controls

Primary mechanism that a host uses to get data from HID sensor devices is by specifying a report interval value. This is the elapsed time period for periodic input report generation. Instead of delivering input reports immediately to the host the device can instead buffer input reports and deliver it in batches. That is, the rate at which a device collects data is decoupled from the rate at which it delivers it to the host. This can result in significant power savings in the processor, especially in the case of continuous sensing applications that must run when the processor goes to sleep. Instead of waking the processor for every single input report, data can be buffered and processed as a whole batch.

Usage Name	Usage Type	Description
Property: Maximum FIFO Events	SV	Indicates the maximum number of input reports that can be stored in a buffer by this sensor. The actual size can be smaller than this value since the FIFO can be shared by multiple sensors.
Property: Report Latency	DV	Specifies the maximum latency that the host can tolerate before receiving a batch of input reports. The device should use this value (along with the report interval) to calculate the number of input reports it should batch before delivering it to the host. When the buffer becomes full, the device will deliver input reports to the host in the order in which the reports were buffered. That is, the oldest input report will be delivered first.
Property: Flush FIFO Events	DF	TRUE indicates any batched input reports in the device's buffer should be immediately flushed to the host where device is to reset this property to FALSE upon completion.
Property: Maximum Power Consumption	SV	Indicates the worst-case power consumption by the device. Default unit of measure is milli-watts, can be overridden using explicit Unit and/or Unit Exponent.

## 21.6 Biometric Sensor Field Usages

These fields are commonly supported by biometric sensors.

Usage Name	Usage Type	Description
Data Field: Biometric	DV	Generic data field for biometric sensor. Vendor defined.
Data Field: Human Presence	SF	TRUE when a human is using the computer, otherwise FALSE.
Data Field: Human Proximity Range	SV	Distance between a human and the computer. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Human Proximity Out of Range	SF	TRUE when the sensor measuring human proximity range indicates <i>out of range</i> meaning the value provided as Human Proximity Range may not be accurate.
Data Field: Human Touch State	SF	TRUE when the touch sensor is being touched, otherwise FALSE. This is not to be confused with single-touch or multitouch digitizers that provide finger position coordinates.
Data Field: Blood Pressure	SV	Indicates a blood pressure without respect to which blood pressure type (systolic and diastolic). This is usually used as a composite value for specifying min, max and accuracy for related blood pressures. Default units is mmHg; cannot be overridden.
Data Field: Blood Pressure Diastolic	SV	Indicates the diastolic blood pressure of the device user. Default units is mmHg; cannot be overridden.
Data Field: Blood Pressure Systolic	SV	Indicates the systolic blood pressure of the device user. Default units is mmHg; cannot be overridden.
Data Field: Heart Rate	SV	Indicates the current heart rate of the device user. Default unit of measure is number of heart beats per minute; cannot be overridden.
Data Field: Resting Heart Rate	SV	Indicates the current resting heart rate or the heart rate of the device user who has not had any recent physical exertion or stimulation. Default unit of measure is number of heart beats per minute; cannot be overridden.
Data Field: Heartbeat Interval	SV	Indicates the timespan between two heart beats (also known as RR interval). Default unit of measure is ms, can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Respiratory Rate	SV	Indicates the current respiratory rate or rate of breath. Default unit of measure is number of breaths per minute; cannot be overridden.
Data Field: SpO2	SV	Measures the percentage of hemoglobin containing oxygen in the blood of the device user. Default units is percent; cannot be overridden.

## 21.7 Electrical Sensor Field Usages

These fields are commonly supported by electrical sensors.

Usage Name	Usage Type	Description
Data Field: Electrical	DV	Generic data field for electrical sensor. Vendor defined.
Data Field: Capacitance	SV	Measures electrical capacitance. Default unit of measure is Farads; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Current	SV	Measures electrical current. Default unit of measure is Amperes; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Electrical Power	SV	Measures electrical power. Default unit of measure is Watts; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Inductance	SV	Measures electrical inductance. Default unit of measure is Henrys; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Resistance	SV	Measures electrical resistance. Default unit of measure is Ohms; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Voltage	SV	Measures electrical voltage. Default unit of measure is Volts; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Frequency	SV	Measures electrical frequency. Default unit of measure is Hertz; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Period	SV	Measures electrical period. Default unit of measure is milliseconds; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Percent of Range	SV	Measures the percent of range provided by a value, such as the position of a potentiometer with respect to the overall physical range of that potentiometer. Can be scaled with a Unit Exponent.



## 21.8 Environmental Sensor Usages

These fields are commonly supported by environmental sensors.

Usage Name	Usage Type	Description
Data Field: Environmental	DV	Generic data field for environmental sensor. Vendor defined.
Data Field: Atmospheric Pressure	SV	Measures atmospheric pressure. Default unit of measure is bars; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Relative Humidity	SV	Measures relative humidity as a percentage.
Data Field: Temperature	SV	Measures temperature. Default unit of measure is degrees Celsius; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Wind Direction	SV	Measures wind direction relative to magnetic north. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Wind Speed	SV	Measures wind speed. Default unit of measure is meters/second; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Air Quality Index	SV	Measures the air quality (or amount of pollutants in the surrounding air). Default unit of measure is AQI defined by the Environmental Protection Agency; cannot be overridden.
Data Field: Equivalent CO2	SV	Measures the equivalent carbon-dioxide concentration in the surrounding air. Default unit of measure is percent; cannot be overridden.
Data Field: Volatile Organic Compound Concentration	SV	Measures the total volatile organic compounds (TVOC) concentration. Default unit of measure is in percent; cannot be overridden.
Data Field: Object Presence	SF	TRUE when an object presence is detected by the computing device, otherwise FALSE.
Data Field: Object Proximity Range	SV	Measures the distance between an object and the computing device. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Object Proximity Out of Range	SF	TRUE when the sensor measuring object proximity range indicates <i>out of range</i> meaning the value provided as Object Proximity Range may not be accurate.

These properties are commonly supported by environmental sensors.

Usage Name	Usage Type	Description
Property: Environmental	DV	Generic property for environmental sensor. Vendor defined.
Property: Reference Pressure	SV	Specifies reference atmospheric pressure at sea level, nominally <i>1976 US Standard Atmosphere</i> air pressure at Sea Level Pressure. Default unit of measure is bars; can be overridden using explicit Unit and/or Unit Exponent.

## 21.9 Light Sensor Usages

These fields are commonly supported by light sensors.

Usage Name	Usage Type	Description
Data Field: Light	DV	Generic data field for light sensor. Vendor defined.
Data Field: Illuminance	SV	Measures illuminance (light level, i.e., luminance per square area). Default unit of measure is Lux; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Color Temperature	SV	Measures the color temperature. Default unit of measure is degrees Kelvin; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Chromaticity	SV	Chromaticity without respect to which axis it occurs in. This is usually used as a composite value for specifying min, max and accuracy for chromaticity.
Data Field: Chromaticity X	SV	Measures chromaticity in the X axis as defined by the CIE 1931 specification. Can be scaled with a Unit Exponent.
Data Field: Chromaticity Y	SV	Measures chromaticity in the Y axis as defined by the CIE 1931 specification. Can be scaled with a Unit Exponent.
Data Field: Consumer IR Sentence Receive	SV	Data message received from a Consumer Infrared controller. Data type is an opaque counted array of bytes; interpretation will depend on host-based middleware.
Data Field: Infrared Light	SV	Measures the amount of infrared light (wavelength of approximately 700nm to 1mm). Default unit of measure is W/mm <sup>2</sup> , can be overridden using explicit Unit and/or Unit Exponent
Data Field: Red Light	SV	Measures the amount of red light (wavelength of approximately 620nm to 700nm). Default unit of measure is W/mm <sup>2</sup> , can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Green Light	SV	Measures the amount of green light (wavelength of approximately 495nm to 570nm). Default unit of measure is W/mm <sup>2</sup> , can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Blue Light	SV	Measures the amount of blue light (wavelength of approximately 450nm to 495nm). Default unit of measure is W/mm <sup>2</sup> , can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Ultraviolet A Light	SV	Measures the amount of ultraviolet A light (wavelength of approximately 315nm to 400nm). Default unit of measure is mW/cm <sup>2</sup> , can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Ultraviolet B Light	SV	Measures the amount of ultraviolet B light (wavelength of approximately 280nm to 315nm). Default unit of measure is mW/cm <sup>2</sup> , can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Ultraviolet Index	SV	Measures the strength of ultraviolet radiation defined by the World Health Organization ultraviolet index standard. Default unit of measure is ultraviolet index unit and cannot be overridden.
Data Field: Near Infrared Light	SV	Measures the amount of infrared light (wavelength of approximately 700nm to 1mm). Default unit of measure is W/mm <sup>2</sup> , can be overridden using explicit Unit and/or Unit Exponent.

These properties are commonly supported by light sensors.

<b>Usage Name</b>	<b>Usage Type</b>	<b>Description</b>
Property: Light	DV	Generic property for light sensor. Vendor defined.
Property: Consumer IR Sentence Send	DV	Data message sent to a Consumer Infrared controller. Data type is an opaque counted array of bytes; interpretation will depend on host-based middleware.
Property: Auto Brightness Preferred	DF	TRUE when this light sensor is preferred to be used for system auto brightness usage, otherwise FALSE.
Property: Auto Color Preferred	DF	TRUE when this light sensor is preferred to be used for system auto color usage, otherwise FALSE.

## 21.10 Location Sensor Field Usages

Usage Name	Usage Type	Description
Data Field: Location	DV	Generic data field for location sensor. Vendor defined.
Data Field: Altitude Antenna Sea Level	SV	Indicates altitude of the antenna, references to sea level. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Differential Reference Station ID	SV	Indicates ID of the differential reference station. The range is 0000 to 1023
Data Field: Altitude Ellipsoid Error	SV	Indicates altitude error referenced to the World Geodetic System (WGS 84) reference ellipsoid. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Altitude Ellipsoid	SV	Indicates altitude referenced to the World Geodetic System (WGS 84) reference ellipsoid. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Altitude Sea Level Error	SV	Indicates altitude error referenced to sea level. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Altitude Sea Level	SV	Indicates altitude referenced to sea level. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Differential GPS Data Age	SV	Indicates age of differential GPS data. Default unit of measure is seconds; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Error Radius	SV	Indicates accuracy of latitude and longitude values. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent. A value of 0 means that the accuracy level is not currently known.
Data Field: Geoidal Separation	SV	Indicates the difference between the World Geodetic System (WGS 84) ellipsoid and mean sea level. Values less than zero indicate that mean sea level is below the reference ellipsoid. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Position Dilution of Precision	SV	Indicates the position dilution of precision.
Data Field: Horizontal Dilution of Precision	SV	Indicates the horizontal dilution of precision.
Data Field: Vertical Dilution of Precision	SV	Indicates the vertical dilution of precision.
Data Field: Latitude	SV	Indicates the latitude. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent. North is positive; South is negative.
Data Field: Longitude	SV	Indicates longitude. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent. East is positive; West is negative.
Data Field: True Heading	SV	Indicates the current heading in relation to true north. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.

Data Field: Magnetic Heading	SV	Indicates the heading in relation to magnetic north. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Magnetic Variation	SV	Indicates the magnetic variation from true north. East is positive; West is negative. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Speed	SV	Indicates the current speed. Default unit of measure is knots; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Satellites in View	SV	Indicates the number of GPS satellites currently in view.
Data Field: Satellites in View Azimuth	SV	Indicates the azimuth of GPS satellites currently in view.
Data Field: Satellites in View Elevation	SV	Indicates the elevation of GPS satellites currently in view.
Data Field: Satellites in View IDs	SV	Indicates the ID of GPS satellites currently in view.
Data Field: Satellites in View PRNs	SV	Indicates the Pseudo-Random Noise codes of GPS satellites currently in view.
Data Field: Satellites in View S/N Ratios	SV	Indicates the Signal-to-Noise Ratio of GPS satellites currently in view.
Data Field: Satellites Used Count	SV	Indicates the number of GPS satellites that are currently being used to calculate a location solution.
Data Field: Satellites Used PRNs	SV	Indicates the Pseudo-Random Noise codes of the GPS satellites currently being used to calculate a location solution.
Data Field: NMEA Sentence	SV	Indicates the current NMEA sentence string.
Data Field: Address Line 1	SV	Indicates street address, first line.
Data Field: Address Line 2	SV	Indicates street address, second line.
Data Field: City	SV	Indicates city.
Data Field: State or Province	SV	Indicates state or province.
Data Field: Country or Region	SV	Indicates country or region represented as an ISO 3166 1-alpha-2 country/region code.
Data Field: Postal Code	SV	Indicates the postal code.

These properties are commonly supported by location sensors.

Usage Name	Usage Type	Description
Property: Location	DV	Generic property for location sensor. Vendor defined.

### 21.10.1 Location Desired Accuracy

Usage Name	Usage Type	Description
<b>Property: Location Desired Accuracy</b>	NArY	Indicates the type of accuracy handling desired by a client application.
Accuracy: Default	Sel	Indicates that the sensor should use its own default accuracy policy.
Accuracy: High	Sel	Indicates that the sensor should optimize for the most accurate location report possible, even if it consumes more energy, costs more money, or uses more connection bandwidth.

Accuracy: Medium	Sel	Indicates that the sensor should strike a balance between accuracy and power consumption.
Accuracy: Low	Sel	Indicates that the sensor should reduce accuracy thereby optimizing for power utilization.

### 21.10.2 Fix Quality

Usage Name	Usage Type	Description
<b>Data Field: Fix Quality</b>	NArY	Indicates fix quality.
Fix Quality: No Fix	Sel	No Fix
Fix Quality: GPS	Sel	GPS
Fix Quality: DGPS	Sel	DPGS

### 21.10.3 Fix Type

Usage Name	Usage Type	Description
<b>Data Field: Fix Type</b>	NArY	Indicates fix type.
Fix Type: No Fix	Sel	No Fix
Fix Type: GPS SPS Mode, Fix Valid	Sel	GPS SPS Mode, Fix Valid
Fix Type: DGPS SPS Mode, Fix Valid	Sel	DGPS SPS Mode, Fix Valid
Fix Type: GPS PPS Mode, Fix Valid	Sel	GPS PPS Mode, Fix Valid
Fix Type: Real Time Kinematic	Sel	Real Time Kinematic
Fix Type: Float RTK	Sel	Float RTK
Fix Type: Estimated (dead reckoned)	Sel	Estimated (dead reckoned)
Fix Type: Manual Input Mode	Sel	Manual Input Mode
Fix Type: Simulator Mode	Sel	Simulator Mode

### 21.10.4 GPS Operation Mode

Usage Name	Usage Type	Description
<b>Data Field: GPS Operation Mode</b>	NArY	Indicates GPS operation mode.
GPS Operation Mode: Manual	Sel	Manually set for 2D or 3D mode
GPS Operation Mode: Automatic	Sel	Automatically can switch between 2D and 3D modes.

### 21.10.5 GPS Selection Mode

Usage Name	Usage Type	Description
<b>Data Field: GPS Selection Mode</b>	NArY	Indicates GPS selection mode

GPS Selection Mode: Autonomous	Sel	Autonomous
GPS Selection Mode: DGPS	Sel	DGPS
GPS Selection Mode: Estimated (dead reckoned)	Sel	Estimated (dead reckoned)
GPS Selection Mode: Manual Input	Sel	Manual Input
GPS Selection Mode: Simulator	Sel	Simulator
GPS Selection Mode: Data Not Valid	Sel	Data Not Valid

### 21.10.6 GPS Status

Usage Name	Usage Type	Description
<b>Data Field: GPS Status</b>	NARY	Indicates current GPS data status
GPS Status Data: Valid	Sel	Data Valid.
GPS Status Data: Not Valid	Sel	Data Not Valid.

## 21.11 Mechanical Sensor Field Usages

These fields are commonly supported by mechanical sensors.

Usage Name	Usage Type	Description
Data Field: Mechanical	DV	Generic data field for mechanical sensor. Vendor defined.
Data Field: Boolean Switch State	SF	Reports the on/off state of a Boolean switch.
Data Field: Boolean Switch Array States	SV	Reports the on/off state of each of an array of Boolean switches.
Data Field: Multivalued Switch Value	SV	Reports the multivalued state of a Multivalued switch.
Data Field: Force	SV	Measures force. Default unit of measure is Newtons; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Absolute Pressure	SV	Measures absolute pressure. Default unit of measure is Pascals; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Gauge Pressure	SV	Measures relative gauge pressure. Default unit of measure is Pascals; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Strain	SV	Measures strain (in percent). Can be scaled with a Unit Exponent.
Data Field: Weight	SV	Measures weight. Default unit of measure is kilograms; can be overridden using explicit Unit and/or Unit Exponent.

These properties are commonly supported by mechanical sensors.

Usage Name	Usage Type	Description
Property: Mechanical	DV	Generic property for mechanical sensor. Vendor defined.
Property: Vibration State	DF	The on/off state of a Haptic feedback vibrator.
Property: Forward Vibration Speed	DV	The forward speed of the vibrator (in percent). Can be scaled with a Unit Exponent.
Property: Backward Vibration Speed	DV	The backward speed of the vibrator (in percent). Can be scaled with a Unit Exponent. Some haptic motors do not support both forward and backward motion. For those that do, setting both forward and backward speeds to non-zero values simultaneously has a vendor-defined behavior.



## 21.12 Motion Sensor Field Usages

These fields are commonly supported by motion sensors.

Usage Name	Usage Type	Description
Data Field: Motion	DV	Generic data field for motion sensor. Vendor defined.
Data Field: Motion State	SF	A flag indicating presence or absence of motion.
Data Field: Acceleration	SV	Linear acceleration magnitude without respect to which axis it occurs in. This is usually used as a composite value for specifying min, max and accuracy for related accelerations. Default unit of measure is G's; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Acceleration Axis X	SV	Linear acceleration along the X axis. Default unit of measure is G's; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Acceleration Axis Y	SV	Linear acceleration along the Y axis. Default unit of measure is G's; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Acceleration Axis Z	SV	Linear acceleration along the Z axis. Default unit of measure is G's; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Angular Velocity	SV	Angular velocity magnitude without respect to which axis it occurs in. This is usually used as a composite value for specifying min, max and accuracy for related velocity. Default unit of measure is degrees/second; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Angular Velocity about X Axis	SV	Angular velocity about the X axis. Default unit of measure is degrees/second; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Angular Velocity about Y Axis	SV	Angular velocity about the Y axis. Default unit of measure is degrees/second; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Angular Velocity about Z Axis	SV	Angular velocity about the Z axis. Default unit of measure is degrees/second; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Angular Position	SV	Angular position without respect to which axis it occurs in. This is usually used as a composite value for specifying min, max and accuracy for related position. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Angular Position about X Axis	SV	Angular position about the roll axis. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Angular Position about Y Axis	SV	Angular position about the pitch axis. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Angular Position about Z Axis	SV	Angular position about the yaw axis. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Motion Speed	SV	Velocity magnitude without respect to direction. Default unit of measure is meters/second; can be overridden using explicit Unit and/or Unit Exponent.

Data Field: Motion Intensity	SV	A positive number indicating intensity of motion if motion is detected (in percent), otherwise 0. Can be scaled with a Unit Exponent.
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## 21.13 Orientation Sensor Field Usages

These fields are commonly supported by orientation sensors.

Usage Name	Usage Type	Description
Data Field: Orientation	DV	Generic data field for orientation sensor. Vendor defined.
Data Field: Heading	SV	Indicates the compass heading without respect to which axis it occurs in. This is usually used as a composite value for specifying min, max and accuracy for related axes. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Heading X Axis	SV	Indicates the compass X axis heading. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Heading Y Axis	SV	Indicates the compass Y axis heading. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Heading Z Axis	SV	Indicates the compass Z axis heading. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Heading Compensated Magnetic North	SV	Indicates compass magnetic heading has been compensated for tilt with respect to earth normal. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Heading Compensated True North	SV	Indicates compass true north heading has been compensated for tilt with respect to earth normal. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Heading Magnetic North	SV	Indicates compass magnetic heading is not compensated. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Heading True North	SV	Indicates compass true north heading is not compensated. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Distance	SV	Indicates the distance magnitude without respect to which axis it occurs in. This is usually used as a composite value for specifying min, max and accuracy for related axes. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Distance X Axis	SV	Indicates the X axis distance. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Distance Y Axis	SV	Indicates the Y axis distance. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Distance Z Axis	SV	Indicates the Z axis distance. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Distance Out-of-Range	SF	TRUE when the sensor measuring distance indicates <i>out of range</i> meaning the value provided as Distance may not be accurate.
Data Field: Tilt	SV	Indicates the inclinometer angle without respect to which axis it occurs in. This is usually used as a composite value for specifying min, max and accuracy for related axes. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.

Data Field: Tilt X Axis	SV	Indicates the inclinometer X axis angle. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Tilt Y Axis	SV	Indicates the inclinometer Y axis angle. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Tilt Z Axis	SV	Indicates the inclinometer Z axis angle. Default unit of measure is degrees; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Rotation Matrix	SV	A 3 x 3 matrix of numbers, all ranging in value from -1.0 to 1.0, representing rotation within a 3D space. No units are specified and scaling is by the Unit Exponent usage.
Data Field: Quaternion	SV	A matrix of 4 values (x, y, z and w, all ranging in value from -1.0 to 1.0) that represent rotation in space about a unit vector. No units are specified and scaling is by the Unit Exponent usage.
Data Field: Magnetic Flux	SV	Indicates the magnetic field strength without respect to which axis it occurs in. This is usually used as a composite value for specifying min, max and accuracy for related axis. Default unit of measure is milligauss; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Magnetic Flux X Axis	SV	Indicates the X axis magnetic field strength. Default unit of measure is milligauss; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Magnetic Flux Y Axis	SV	Indicates the Y axis magnetic field strength. Default unit of measure is milligauss; can be overridden using explicit Unit and/or Unit Exponent.
Data Field: Magnetic Flux Z Axis	SV	Indicates the Z axis magnetic field strength. Default unit of measure is milligauss; can be overridden using explicit Unit and/or Unit Exponent.

In addition to the field usages listed above, Data Field: Magnetic Heading and Data Field: Magnetic Variation are commonly used with Orientation sensors.

### 21.13.1 Magnetometer Accuracy

Magnetometer sensors are susceptible to electromagnetic field interference from the surrounding environment or the computing device itself. Because orientation sensors such as compass, inclinometer, and device orientation rely on magnetometer data, as interference increases, sensor accuracy degrades. In many cases dynamic calibration is needed to account for the changing electromagnetic environment, which requires the device to be moved around all three device axis.

The below specifies a magnetometer accuracy data field usage to be included in each orientation input report. Magnetometer accuracy will be one of low, medium, or high, indicating how closely the data represents the heading of a magnetically-calibrated device with respect to a horizontal plane. Here magnetometer accuracy relates to the component of the fused sensor data impacted by the magnetic field and not just the raw magnetic field vector. For example magnetometer accuracy for an inclinometer would describe the accuracy of the Z (yaw) component of the data, but not the X and Y components. Often computing an absolute accuracy in degrees is computationally expensive or impossible as data values vary within some confidence interval. This solution allows magnetometer accuracy to be specified at a reasonable granularity: low, medium, and high. The below defines only the relative meaning of each of these values; an explicit definition is left to the implementation.

With these usages, the consumer of the data is responsible for determining minimum acceptable accuracy and taking the appropriate action. There is no event defined indicating calibration is needed or complete, and there is no means to instruct the sensor to enter a special calibration mode. It is expected that the magnetometer accuracy value will change in successive data reports as calibration changes.

Usage Name	Usage Type	Description
<b>Data Field: Magnetometer Accuracy</b>	NARY	Indicates accuracy of the sensor data component impacted by the magnetic field.
Magnetometer Accuracy: Low	Sel	Sensor is providing a low level of magnetometer accuracy. It should be calibrated for reliable data.
Magnetometer Accuracy: Medium	Sel	Sensor is providing a medium level of magnetometer accuracy and may benefit from additional calibration data.
Magnetometer Accuracy: High	Sel	Sensor is fully calibrated and providing a high level of magnetometer accuracy.

### 21.13.2 Simple Orientation Direction

Usage Name	Usage Type	Description
<b>Data Field: Simple Orientation Direction</b>	NARY	Indicates the current orientation of the device with respect to the following types.
Simple Orientation Direction: Not Rotated	Sel	Not Rotated, front face of device is in its default orientation.
Simple Orientation Direction: Rotated 90 Degrees CCW	Sel	Rotated 90 Degrees CCW, front face of device is rotated 90 degrees counter clock-wise its default position.
Simple Orientation Direction: Rotated 180 Degrees CCW	Sel	Rotated 180 Degrees CCW, front face of device is rotated 180 degrees counter clock-wise its default position.
Simple Orientation Direction: Rotated 270 Degrees CCW	Sel	Rotated 270 Degrees CCW, front face of device is rotated 270 degrees counter clock-wise its default position.
Simple Orientation Direction: Face Up	Sel	Face Up, front face of device is pointing away from the ground.
Simple Orientation Direction: Face Down	Sel	Face Down, front face of device is pointing towards the ground.

## 21.14 Scanner Sensor Field Usages

These fields are commonly supported by scanner sensors.

Usage Name	Usage Type	Description
Data Field: Scanner	DV	Generic data field for scanner sensor. Vendor defined.
Data Field: RFID Tag 40 Bit	SV	Indicates the 40-bit radio frequency ID tag value.
Data Field: NFC Sentence Receive	SV	Data message received from an NFC controller. Data type is an opaque counted array of bytes; interpretation will depend on host-based middleware (HCI specification protocol is typical).

These properties are commonly supported by scanner sensors.

Usage Name	Usage Type	Description
Property: Scanner	DV	Generic property for scanner sensor. Vendor defined.
Property: NFC Sentence Send	SV	Data message sent to an NFC controller. Data type is an opaque counted array of bytes; interpretation will depend on hostbased middleware (HCI specification protocol is typical).

## 21.15 Time Sensor Field Usages

These fields are commonly supported by time sensors.

Usage Name	Usage Type	Description
Data Field: Time	DV	Generic data field for time sensor. Vendor defined.
Data Field: Year	SV	Indicates the current year.
Data Field: Month	SV	Indicates the current month (1 – 12).
Data Field: Day	SV	Indicates the current day of the month (1 – 31).
Data Field: Hour	SV	Indicates the current hour (00 – 23).
Data Field: Minute	SV	Indicates the current minute (00 – 59).
Data Field: Second	SV	Indicates the current second (00 – 59).
Data Field: Millisecond	SV	Indicates the current millisecond (000 – 999).
Data Field: Timestamp	SV	Indicates the current time (UTC) expressed in a format compliant to the C language library <code>_time64()</code> function (i.e., the number of seconds since 1/1/1970 00:00:00 UTC).
Data Field: Julian Day of Year	SV	Indicates the day of the year (1 – 366).
Data Field: Time Since System Boot	SV	Specifies the amount of time that has passed since the host system's boot. Default unit of measure is seconds; can be overridden using explicit Unit and/or Unit Exponent.

These properties are commonly supported by time sensors.

Usage Name	Usage Type	Description
Property: Time	DV	Specifies the local time zone offset from UTC. Default unit of measure is minutes; can be overridden using explicit Unit and/or Unit Exponent.
Property: Time Zone Offset From UTC	DV	Specifies the local time zone offset from UTC. Default unit of measure is minutes; can be overridden using explicit Unit and/or Unit Exponent.
Property: Time Zone Name	DV	Specifies the textual name of the local time zone.
Property: Daylight Savings Time Observed	DF	Specifies whether or not Daylight Savings Time or Summer Time is observed in the local area.
Property: Time Trim Adjustment	DV	Specifies a trim factor used to correct inaccuracies in the Real-Time Clock. It is a signed unit-less value, and implementation dependent.
Property: Arm Alarm	DF	Specifies whether the Alarm function should be armed (TRUE) or disarmed (FALSE). The alarm is automatically disarmed when it expires (i.e., <i>goes off</i> ).

### 21.15.1 Day of Week

Usage Name	Usage Type	Description
<b>Data Field: Day of Week</b>	NARY	Indicates the current day of the week.
Day of Week: Sunday	Sel	Sunday
Day of Week: Monday	Sel	Monday
Day of Week: Tuesday	Sel	Tuesday

Day of Week: Wednesday	Sel	Wednesday
Day of Week: Thursday	Sel	Thursday
Day of Week: Friday	Sel	Friday
Day of Week: Saturday	Sel	Saturday



## 21.16 Custom Sensor Field Usages

These fields are commonly supported by custom sensors.

Usage Name	Usage Type	Description
Data Field: Custom	DV	Generic data field for custom sensor. Vendor defined.
Data Field: Custom Usage	SV	Indicates the HID Sensor Usage. See custom data field Custom Type ID if searching for a data field to assign a unique identifier for a custom sensor.
Data Field: Custom Type ID	SV	A 16-byte GUID to uniquely identify a Custom Sensor instance.
Data Field: Custom Boolean Array	SV	Reports the on/off state of each of an array of Boolean variables.
Data Field: Custom Value	SV	Custom value without respect to which specific custom value field is being used. This is usually used as a composite value for specifying min, max and accuracy for custom values. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 1	SV	A first custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 2	SV	A second custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 3	SV	A third custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 4	SV	A fourth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 5	SV	A fifth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 6	SV	A sixth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 7	SV	A seventh custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 8	SV	A eighth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 9	SV	A ninth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 10	SV	A tenth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 11	SV	A eleventh custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 12	SV	A twelfth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 13	SV	A thirteenth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 14	SV	A fourteenth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 15	SV	A fifteenth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 16	SV	A sixteenth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.

Data Field: Custom Value 17	SV	A seventeenth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 18	SV	A eighteenth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 19	SV	A nineteenth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 20	SV	A twentieth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 21	SV	A twenty-first custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 22	SV	A twenty-second custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 23	SV	A twenty-third custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 24	SV	A twenty-fourth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 25	SV	A twenty-fifth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 26	SV	A twenty-sixth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 27	SV	A twenty-seventh custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Data Field: Custom Value 28	SV	A twenty-eighth custom value. Units are specified by the Units usage and scaling by the Unit Exponent usage.

## 21.17 Custom Sensor Property Usages

These properties are commonly supported by custom sensors.

Usage Name	Usage Type	Description
Property: Custom Value 1	DV	A first custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 2	DV	A second custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 3	DV	A third custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 4	DV	A fourth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 5	DV	A fifth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 6	DV	A sixth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 7	DV	A seventh custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 8	DV	A eighth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 9	DV	A ninth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 10	DV	A tenth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 11	DV	A eleventh custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 12	DV	A twelfth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 13	DV	A thirteenth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 14	DV	A fourteenth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 15	DV	A fifteenth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.
Property: Custom Value 16	DV	A sixteenth custom property value. Units are specified by the Units usage and scaling by the Unit Exponent usage.

## 21.18 Generic Sensor Field Usages

These fields are commonly supported by generic sensors.

Usage Name	Usage Type	Description
Data Field: Generic	DV	Generic data field for generic sensor. Vendor defined.
Data Field: Generic GUID or PROPERTYKEY	SV	A 30-byte structure GUID_OR_PROPERTYKEY
Data Field: Generic Category GUID	SV	A 16-byte GUID used to specify an <i>inline</i> sensor category. The GUID is followed by a field that indicates the sensor category value assigned to that GUID.
Data Field: Generic Type GUID	SV	A 16-byte GUID used to specify an <i>inline</i> sensor type. The GUID is followed by a field that indicates the sensor type value assigned to that GUID.
Data Field: Generic Event PROPERTYKEY	SV	A 20-byte PROPERTYKEY used to specify an <i>inline</i> sensor event. The PROPERTYKEY is followed by a field that indicates the event value assigned to that PROPERTYKEY.
Data Field: Generic Property PROPERTYKEY	SV	A 20-byte PROPERTYKEY used to specify an <i>inline</i> sensor property. The PROPERTYKEY is followed by a field that indicates the property value assigned to that PROPERTYKEY.
Data Field: Generic Data Field PROPERTYKEY	SV	A 20-byte PROPERTYKEY used to specify an <i>inline</i> sensor data field. The PROPERTYKEY is followed by a field that indicates the data field value assigned to that PROPERTYKEY.
Data Field: Generic Event	SV	Usage ID for the field that follows the Generic Event PROPERTYKEY.
Data Field: Generic Property	SV	Usage ID for the field that follows the Generic Property PROPERTYKEY.
Data Field: Generic Data Field	SV	Usage ID for the field that follows the Generic Data Field PROPERTYKEY.
Data Field: Enumerator Table Row Index	SV	When using the <i>Enumerator</i> top-level-collection strategy, this usage specifies the Row index of the Enumerator's table.
Data Field: Enumerator Table Row Count	SV	When using the <i>Enumerator</i> top-level-collection strategy, this usage specifies the total count of Rows in the Enumerator's table.
Data Field: Generic GUID	SV	A 16-byte GUID. May be a Category GUID or a Type GUID; as specified by Generic GUID or PROPERTYKEY kind.
Data Field: Generic PROPERTYKEY	SV	A 20-byte PROPERTYKEY. May be an Event PROPERTYKEY, Property PROPERTYKEY, or a Data Field PROPERTYKEY; as specified by Generic GUID or PROPERTYKEY kind.
Data Field: Generic Top Level Collection ID	SV	Identifies the HID Top Level Collection ID for the Row in the Enumerator's table.
Data Field: Generic Report ID	SV	Identifies the HID Report ID for the Row in the Enumerator's table.
Data Field: Generic Report Item Position Index	SV	Indicates the 1-based sequential position of the Property or Data Field in its Report.
Data Field: Generic Report Size	SV	Indicates the HID Report Size for the Row in the Enumerator's table.
Data Field: Generic Report Count	SV	Indicates the HID Report Count for the Row in the Enumerator's table.
Property: Generic	DV	Generic property for generic sensor. Vendor defined.
Property: Enumerator Table Row Index	DV	When using the <i>Enumerator</i> top-level-collection strategy, this usage specifies the Row index of the Enumerator's table.

Property: Enumerator Table Row Count	SV	When using the <i>Enumerator</i> top-level-collection strategy, this usage specifies the total count of Rows in the Enumerator's table.
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These properties are commonly supported by generic sensors.

Usage Name	Usage Type	Description
Property: Generic	DV	Generic property for generic sensor. Vendor defined.
Property: Enumerator Table Row Index	DV	When using the <i>Enumerator</i> top-level-collection strategy, this usage specifies the Row index of the Enumerator's table.
Property: Enumerator Table Row Count	SV	When using the <i>Enumerator</i> top-level-collection strategy, this usage specifies the total count of Rows in the Enumerator's table.

### 21.18.1 Generic GUID or PROPERTYKEY kind

Usage Name	Usage Type	Description
<b>Data Field: Generic GUID or PROPERTYKEY kind</b>	NAry	Indicates what kind of GUID or PROPERTYKEY is being used.
Kind: Category	Sel	Sensor Category GUID.
Kind: Type	Sel	Sensor Type GUID.
Kind: Event	Sel	Sensor Event PROPERTYKEY.
Kind: Property	Sel	Sensor Property PROPERTYKEY.
Kind: Data Field	Sel	Sensor Data Field PROPERTYKEY.

### 21.18.2 Generic Firmware VARTYPE

Usage Name	Usage Type	Description
<b>Data Field: Generic Firmware VARTYPE</b>	NAry	Identifies the firmware data type associated with the Property or Data Field in the Row in the Enumerator's table.
VT_NULL	Sel	Empty
VT_BOOL	Sel	Boolean
VT_UI1	Sel	Byte
VT_I1	Sel	Character
VT_UI2	Sel	Unsigned Short
VT_I2	Sel	Short
VT_UI4	Sel	Unsigned Long
VT_I4	Sel	Long
VT_UI8	Sel	Unsigned Long Long
VT_I8	Sel	Long Long
VT_R4	Sel	Float
VT_R8	Sel	Double
VT_WSTR	Sel	Wide String
VT_STR	Sel	Narrow String
VT_CLSID	Sel	Guid
VT_VECTOR VT_UI1	Sel	Opaque Structure

VT_F16E0	Sel	16-bit Float with Unit Exponent 0
VT_F16E1	Sel	16-bit Float with Unit Exponent 1
VT_F16E2	Sel	16-bit Float with Unit Exponent 2
VT_F16E3	Sel	16-bit Float with Unit Exponent 3
VT_F16E4	Sel	16-bit Float with Unit Exponent 4
VT_F16E5	Sel	16-bit Float with Unit Exponent 5
VT_F16E6	Sel	16-bit Float with Unit Exponent 6
VT_F16E7	Sel	16-bit Float with Unit Exponent 7
VT_F16E8	Sel	16-bit Float with Unit Exponent 8
VT_F16E9	Sel	16-bit Float with Unit Exponent 9
VT_F16EA	Sel	16-bit Float with Unit Exponent A
VT_F16EB	Sel	16-bit Float with Unit Exponent B
VT_F16EC	Sel	16-bit Float with Unit Exponent C
VT_F16ED	Sel	16-bit Float with Unit Exponent D
VT_F16EE	Sel	16-bit Float with Unit Exponent E
VT_F16EF	Sel	16-bit Float with Unit Exponent F
VT_F32E0	Sel	32-bit Float with Unit Exponent 0
VT_F32E1	Sel	32-bit Float with Unit Exponent 1
VT_F32E2	Sel	32-bit Float with Unit Exponent 2
VT_F32E3	Sel	32-bit Float with Unit Exponent 3
VT_F32E4	Sel	32-bit Float with Unit Exponent 4
VT_F32E5	Sel	32-bit Float with Unit Exponent 5
VT_F32E6	Sel	32-bit Float with Unit Exponent 6
VT_F32E7	Sel	32-bit Float with Unit Exponent 7
VT_F32E8	Sel	32-bit Float with Unit Exponent 8
VT_F32E9	Sel	32-bit Float with Unit Exponent 9
VT_F32EA	Sel	32-bit Float with Unit Exponent A
VT_F32EB	Sel	32-bit Float with Unit Exponent B
VT_F32EC	Sel	32-bit Float with Unit Exponent C
VT_F32ED	Sel	32-bit Float with Unit Exponent D
VT_F32EE	Sel	32-bit Float with Unit Exponent E
VT_F32EF	Sel	32-bit Float with Unit Exponent F

### 21.18.3 Generic Unit of Measure

Usage Name	Usage Type	Description
<b>Data Field: Generic Unit of Measure</b>	NArY	Indicates the HID Unit for the Row in the Enumerator's table. These are used in lieu of explicit Unit() declarations in the HID Report Descriptor for Generic Sensors.
Unit: Not Specified	Sel	Not Specified
Unit: Lux	Sel	Lux
Unit: Degrees Kelvin	Sel	Degrees Kelvin

Unit: Degrees Celsius	Sel	Degrees Celsius
Unit: Pascal	Sel	Pascal
Unit: Newton	Sel	Newton
Unit: Meters/Second	Sel	Meters/Second
Unit: Kilogram	Sel	Kilogram
Unit: Meter	Sel	Meter
Unit: Meters/Second/Second	Sel	Meters/Second/Second
Unit: Farad	Sel	Farad
Unit: Ampere	Sel	Ampere
Unit: Watt	Sel	Watt
Unit: Henry	Sel	Henry
Unit: Ohm	Sel	Ohm
Unit: Volt	Sel	Volt
Unit: Hertz	Sel	Hertz
Unit: Bar	Sel	Bar
Unit: Degrees Anti-clockwise	Sel	Degrees Anti-clockwise
Unit: Degrees Clockwise	Sel	Degrees Clockwise
Unit: Degrees	Sel	Degrees
Unit: Degrees/Second	Sel	Degrees/Second
Unit: Degrees/Second/Second	Sel	Degrees/Second/Second
Unit: Knot	Sel	Knot
Unit: Percent	Sel	Percent
Unit: Second	Sel	Second
Unit: Millisecond	Sel	Millisecond
Unit: G	Sel	G
Unit: Bytes	Sel	Bytes
Unit: Milligauss	Sel	Milligauss
Unit: Bits	Sel	Bits

#### 21.18.4 Generic Unit Exponent

Usage Name	Usage Type	Description
<b>Data Field: Generic Unit Exponent</b>	NARY	Indicates the HID Unite Exponent for the Row in the Enumerator's table.
Exponent 0	Sel	1
Exponent 1	Sel	10
Exponent 2	Sel	100
Exponent 3	Sel	1 000
Exponent 4	Sel	10 000
Exponent 5	Sel	100 000
Exponent 6	Sel	1 000 000
Exponent 7	Sel	10 000 000
Exponent 8	Sel	0.000 000 01

Exponent 9	Sel	0.000 000 1
Exponent A	Sel	0.000 001
Exponent B	Sel	0.000 01
Exponent C	Sel	0.000 1
Exponent D	Sel	0.001
Exponent E	Sel	0.01
Exponent F	Sel	0.1



## 21.19 Personal Activity Sensor Field Usages

These fields are commonly supported by personal activity sensors.

Usage Name	Usage Type	Description
Data Field: Personal Activity	DV	Generic data field for personal activity sensor. Vendor defined.
Data Field: Step Count	SV	Indicates the number of footsteps take since last device reset.
Data Field: Step Count Reset	DF	If present in feature report, the host setting this to TRUE indicates device is to reset it's step counter to 0, where the device is to set the flag back to FALSE upon completeion of the reset.  If present in input report, TRUE indicates the step count has been reset since the previous input report, where a reset could be due to either the device itself being reset or the device counter rolling over.
Data Field: Step Duration	SV	Indicates the cumulative length of time of footsteps taken since last device reset.

These properties are commonly supported by personal activity sensors.

Usage Name	Usage Type	Description
Property: Minimum Activity Detection Interval	DV	Indicates the minimum time required by the device to detect an activity. This data field is per supported activity. Default unit of measure is seconds; can be overridden using explicit Unit and/or Unit Exponent.
<b>Property: Supported Activity Types</b>	NAry	Indicates the activity types which can be detected by the device. This data field reuses the selectors mentioned in the Activity Type data field.
<b>Property: Subscribed Activity Types</b>	NAry	Indicates the activity types which the host request to receive input reports for. This data field reuses the selectors mentioned in the Activity Type data field.
<b>Property: Supported Step Types</b>	NAry	Indicates the step types which can be detected by the device. This data field reuses the selectors mentioned in the Step Type data field.
<b>Property: Subscribed Step Types</b>	NAry	Indicates the step types which the host request to receive input reports for. This data field reuses the selectors mentioned in the Step Type data field.
Property: Floor Height	SV	Indicates the height of a single floor. Floors are a rough distance of height travelled during an activity. Default unit of measure is meters; can be overridden using explicit Unit and/or Unit Exponent.

### 21.19.1 Activity Types

Usage Name	Usage Type	Description
<b>Data Field: Activity Type</b>	NAry	Indicates a type of Activity.
Activity Type: Unknown	Sel	The device cannot determine the current activity.
Activity Type: Stationary	Sel	The device itself (not the user) is laying still and not moving.
Activity Type: Fidgeting	Sel	The device detects the user is fidgeting or moving restlessly.

Activity Type: Walking	Sel	The device detects the user is walking.
Activity Type: Running	Sel	The device detects the user is running.
Activity Type: In Vehicle	Sel	The device detects the user is in a moving vehicle.
Activity Type: Biking	Sel	The device detects the user is riding a bike.
Activity Type: Idle	Sel	The device detects the user is idle, or not moving but still actively using the device.

### 21.19.2 Activity State

Usage Name	Usage Type	Description
<b>Data Field: Activity State</b>	NARY	Indicates Activity state change.
Activity State: No State Change	Sel	No State change.
Activity State: Start Activity	Sel	Start Activity.
Activity State: End Activity	Sel	End Activity

### 21.19.3 Device Position

Usage Name	Usage Type	Description
<b>Data Field: Device Position</b>	NARY	Indicates a type of position or placement of the device.
Device Position: Unknown	Sel	The device cannot detect its current placement.
Device Position: Unchanged	Sel	The device's placement has not changed since the previous report.
Device Position: On Desk	Sel	The user has placed the device on a desk or table.
Device Position: In Hand	Sel	The user is holding the device in their hands.
Device Position: Moving in Bag	Sel	The device is moving inside a bag.
Device Position: Stationary in Bag	Sel	The device is stationary inside a bag.

### 21.19.4 Step Type

Usage Name	Usage Type	Description
<b>Data Field: Step Type</b>	NARY	Indicates a type of footstep.
Step Type: Unknown	Sel	The device cannot determine the current step type, note that this is also to be used if the device does not have the ability to distinguish between different step types.
Step Type: Running	Sel	The footsteps were taken while the device user was running.
Step Type: Walking	Sel	The footsteps were taken while the device user was walking.

## 21.20 Foldable Device Usages

Foldable device form-factors have two integrated display-panels connected by a hinge that allows a user to put the device in various configurations to be used like a book, laptop or tablet.

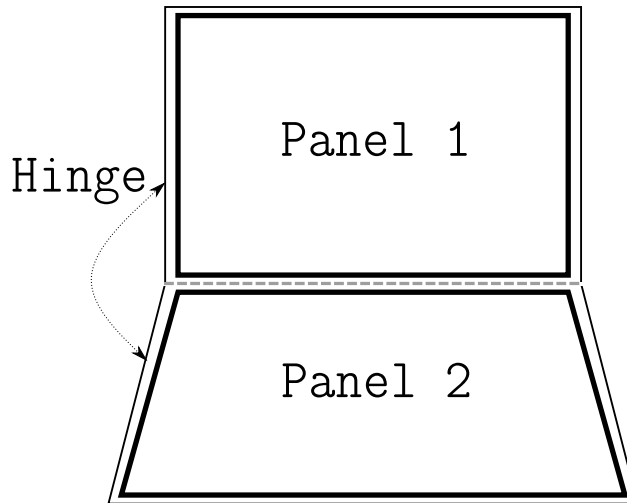


Figure 21.1: Foldable Device

### 21.20.1 Hinge Sensors

A hinge sensor is integrated into the chassis of foldable form-factor systems to enable the Host to detect the angle between the two display-panels.

Usage Name	Usage Type	Description
Data Field: Hinge	SV/DV	Generic data field for hinge sensor. Vendor defined.
Data Field: Hinge Angle	SV/DV	Measures the interior hinge angle (in degrees) between two panels in a system. This field is also used to expose absolute change sensitivity for a hinge angle sensor when used with a modifier see <a href="#">Section 21.2 Modifiers</a>

### 21.20.2 Gesture Sensors

Foldable form factor chassis with dual display-panels allows the user to transition to experiences where only one of the two sides are active. When this happens, the Host must leave only one of the two displays powered on. Sensors integrated on both sides of the chassis can be used to provides hints along with other heuristics, to decide which displays should be active.

Specifics of gestures like timing characteristics can change from one system to another. (e.g. a pocketable system can have different timing specifications for when this gesture should be report and that can be different for systems that are larger.)

Instead of detecting gestures within the Host (by consuming raw data), it's much more power efficient to have a low power device attached to the Host (typically a microcontroller or on SoC sensor hub) process the sensor data and report these gestures.

#### 21.20.2.1 Chassis Flip Gesture

A **Chassis Flip Gesture** shall be reported when the entire system (inclusive of whole chassis) moves around the axis of the hinge by 180° (i.e. user flips system to interact with the other display).

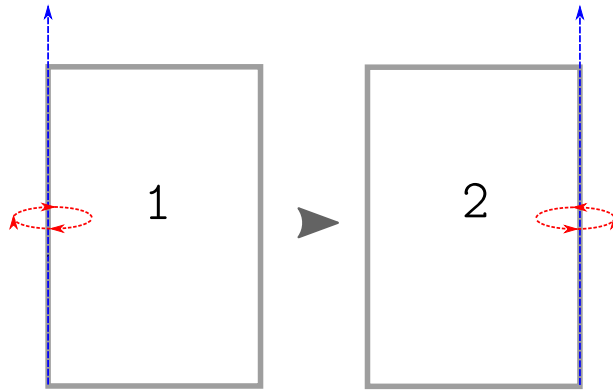


Figure 21.2: Chassis Flip Gesture

### 21.20.2.2 Hinge Fold Gesture

A **Hinge Fold Gesture** shall be reported when one or both panels attached by a hinge moves at least 90° with respect to each other about the axis of the hinge (i.e. user folds panels all the way back).

There is no limit on speed of this movement as that can vary from one kind of system to another.

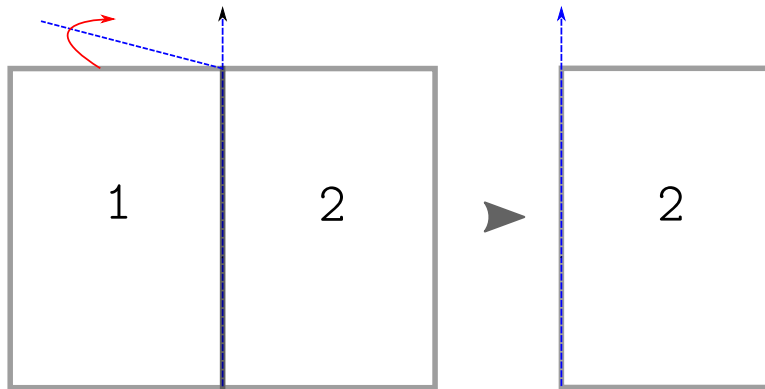


Figure 21.3: Hinge Fold Gesture

### 21.20.2.3 Gesture Sensor Usages

Usage Name	Usage Type	Description
Data Field: Gesture Sensor	DV	Generic data field for gesture sensor. Vendor defined.
Data Field: Hinge Fold Initial Angle	SV	Indicates the initial value of the hinge angle when the gesture started.
Data Field: Hinge Fold Final Angle	SV	Indicates the final value of the hinge angle when the gesture ended.

### 21.20.2.4 Gesture State Usages

Chassis-Flip/Hinge-Fold gesture sensors will use the following named array to notify the host about state of a gesture.

*Note: For simple gestures there may not be a need to report states other than **Completed**.*

Usage Name	Usage Type	Description
<b>Data Field: Gesture State</b>	NArY	Exposes gestures from the device.

Gesture State: Unknown	Sel	Gesture state is unknown.
Gesture State: Started	Sel	Detected that the gesture has started.
Gesture State: Completed	Sel	Detected that the gesture has completed.
Gesture State: Cancelled	Sel	Detected that the gesture has been cancelled.

### 21.20.2.5 Hinge Fold Contributing Panel Usages

Hinge-Fold gesture sensors will use the following named array to notify the host about which panel contributed to the gesture.

Usage Name	Usage Type	Description
<b>Data Field: Hinge Fold Contributing Panel</b>	NAry	Named array to indicate the panel that contributed to the fold gesture.
Hinge Fold Contributing Panel: Unknown	Sel	Unknown which panel contributed to the gesture.
Hinge Fold Contributing Panel: Panel 1	Sel	Panel 1 contributed most to the fold gesture.
Hinge Fold Contributing Panel: Panel 2	Sel	Panel 2 contributed most to the fold gesture
Hinge Fold Contributing Panel: Both	Sel	Both the panels contributed to the fold gesture

### 21.20.2.6 Hinge Fold Type Usages

Hinge-Fold gesture sensors will use the following named array to notify the host if the hinge is opening or closing.

Usage Name	Usage Type	Description
<b>Data Field: Hinge Fold Type</b>	NAry	Named array to indicate whether the fold gesture was due to the hinge angle increasing or decreasing (opening or closing of the hinge)
Hinge Fold Type: Unknown	Sel	Unknown
Hinge Fold Type: Increasing	Sel	Hinge fold due to increasing angle (opening)
Hinge Fold Type: Decreasing	Sel	Hinge fold due to decreasing angle (closing)

## 22 Medical Instrument Page (0x40)

This page provides usage definitions for medical instruments.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Medical Ultrasound</b>	CA	<a href="#">22.1</a>
02-1F	<i>Reserved</i>		
20	VCR/Acquisition	OOC	<a href="#">22.2</a>
21	Freeze/Thaw	OOC	<a href="#">22.2</a>
22	Clip Store	OSC	<a href="#">22.2</a>
23	Update	OSC	<a href="#">22.2</a>
24	Next	OSC	<a href="#">22.2</a>
25	Save	OSC	<a href="#">22.2</a>
26	Print	OSC	<a href="#">22.2</a>
27	Microphone Enable	OSC	<a href="#">22.2</a>
28-3F	<i>Reserved</i>		
40	Cine	LC	<a href="#">22.2</a>
41	Transmit Power	LC	<a href="#">22.2</a>
42	Volume	LC	<a href="#">22.2</a>
43	Focus	LC	<a href="#">22.2</a>
44	Depth	LC	<a href="#">22.2</a>
45-5F	<i>Reserved</i>		
60	Soft Step - Primary	LC	<a href="#">22.2</a>
61	Soft Step - Secondary	LC	<a href="#">22.2</a>
62-6F	<i>Reserved</i>		
70	Depth Gain Compensation	LC	<a href="#">22.3</a>
71-7F	<i>Reserved</i>		
80	Zoom Select	OSC	<a href="#">22.4</a>
81	Zoom Adjust	LC	<a href="#">22.4</a>
82	Spectral Doppler Mode Select	OSC	<a href="#">22.4</a>
83	Spectral Doppler Adjust	LC	<a href="#">22.4</a>
84	Color Doppler Mode Select	OSC	<a href="#">22.4</a>
85	Color Doppler Adjust	LC	<a href="#">22.4</a>
86	Motion Mode Select	OSC	<a href="#">22.4</a>
87	Motion Mode Adjust	LC	<a href="#">22.4</a>
88	2-D Mode Select	OSC	<a href="#">22.4</a>
89	2-D Mode Adjust	LC	<a href="#">22.4</a>
8A-9F	<i>Reserved</i>		
A0	Soft Control Select	OSC	<a href="#">22.4</a>
A1	Soft Control Adjust	LC	<a href="#">22.4</a>
A2-FFFF	<i>Reserved</i>		

Table 22.1: Medical Instrument Page

## 22.1 Ultrasound Devices

Usage Name	Usage Type	Description
Medical Ultrasound	CA	An application-level collection that identifies a device containing ultrasound controls, used for medical diagnostics.

## 22.2 Acquisition Controls

Usage Name	Usage Type	Description
VCR/Acquisition	OOC	Toggles display between playback (VCR) and live acquisition modes.
Freeze/Thaw	OOC	Toggles display between Pause and Play (Thaw) or Acquire and Hold (Freeze).
Clip Store	OSC	Store Ultrasound Frames.
Update	OSC	Forces an update of the image on the screen.
Next	OSC	Next Caliper. Calipers are user controllable cursors on the display that can be positioned to provide measurements. When asserted this usage deselects the current caliper and selects the next.
Save	OSC	Save the Ultrasound Image.
Print	OSC	Print the Ultrasound Image.
Microphone Enable	OOC	Toggles Dictation Microphone Enable.
Cine	LC	Steps through acquisition frames.
Transmit Power	LC	Adjusts overall ultrasound transmitter power between minimum and maximum values.
Volume	LC	Adjust ultrasound monitor-speaker volume.
Focus	LC	Adjusts ultrasound beam focus.
Depth	LC	Adjusts ultrasound window depth between minimum and maximum values.
Soft Step - Primary	LC	Primary programmable toggle/adjustment control for menu items.
Soft Step - Secondary	LC	Secondary programmable toggle/adjustment control for menu items.



## 22.3 Signal Modulation

Usage Name	Usage Type	Description
Depth Gain Compensation	LC	A Logical Collection containing sliders used for adjusting signal strength at various depths. e.g. If 6 sliders are contained in the Dept Gain Compensation collection then displayed echo scan depth will be divided into equal 6 slices, where the gain associated with each slice is controlled by the respective slider. The first slider declared in the report descriptor controls the slice closest to the sensor.

## 22.4 Acquisition and Display Mode Controls

A device defines individual *Adjust* controls for each mode. These controls may always be enabled or they may require that a *Select* control be asserted to enable them.

Usage Name	Usage Type	Description
Zoom Select	OSC	Selects Zoom Adjustment Mode, enables the zoom adjust control.
Zoom Adjust	LC	Adjusts Zoom value or magnification.
Spectral Doppler Mode Select	OSC	Enables Spectral Doppler Mode. Spectral Doppler Mode displays all of the frequency content at a specified position. When the mode is entered the user will select a point on the echo image for Spectral Doppler acquisition. The display is shared between Spectral Doppler output and echo image. Vertical columns of the Spectral Doppler output represent the frequency spectrum of the selected point. The Spectral Doppler output might be a snapshot in time or a trace that varies over time.
Spectral Doppler Mode Adjust	LC	Adjusts sensitivity of Spectral Doppler Mode output.
Color Doppler Mode Select	OSC	Enables Color Doppler Mode. Color Doppler Mode superimposes positional Doppler information on the echo image, providing the instantaneous display of maximum velocity at each image sample point.
Color Doppler Mode Adjust	LC	Adjusts sensitivity the Color Doppler effect.
Motion Mode Select	OSC	Enables Motion Mode.
Motion Mode Adjust	LC	Adjusts sensitivity of Motion Mode output
2-D Mode Select	OSC	Selects 2-D Mode. 2-D Mode is the classic ultrasound echo image.
2-D Mode Adjust	LC	Adjusts sensitivity of 2-D Mode output.
Soft Control Select	OSC	Enables Soft Control Adjust and can be used to step through various mode parameters that can be adjusted.
Soft Control Adjust	LC	Programmable adjustment. This control allows additional parameters associated with the current mode to be adjusted.

## 23 Braille Display Page (0x41)

Braille display allow visually impaired computer users to read out text using raised pins. The pins are electro-mechanically activated. These devices also have support for controls that help navigate the computer screen. Typically, braille displays interface with software known as a screen reader in order to perform this navigation.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>Braille Display</b>	CA	<a href="#">23.1</a>
02	<b>Braille Row</b>	NAry	<a href="#">23.2</a>
03	8 Dot Braille Cell	DV	<a href="#">23.2</a>
04	6 Dot Braille Cell	DV	<a href="#">23.2</a>
05	Number of Braille Cells	DV	<a href="#">23.2</a>
06	<b>Screen Reader Control</b>	NAry	<a href="#">23.5</a>
07	Screen Reader Identifier	DV	<a href="#">23.6</a>
08-F9	<i>Reserved</i>		
FA	<b>Router Set 1</b>	NAry	<a href="#">23.3</a>
FB	<b>Router Set 2</b>	NAry	<a href="#">23.3</a>
FC	<b>Router Set 3</b>	NAry	<a href="#">23.3</a>
FD-FF	<i>Reserved</i>		
100	Router Key	Sel	<a href="#">23.3</a>
101	Row Router Key	Sel	<a href="#">23.3</a>
102-1FF	<i>Reserved</i>		
200	<b>Braille Buttons</b>	NAry	<a href="#">23.4</a>
201	Braille Keyboard Dot 1	Sel	<a href="#">23.4</a>
202	Braille Keyboard Dot 2	Sel	<a href="#">23.4</a>
203	Braille Keyboard Dot 3	Sel	<a href="#">23.4</a>
204	Braille Keyboard Dot 4	Sel	<a href="#">23.4</a>
205	Braille Keyboard Dot 5	Sel	<a href="#">23.4</a>
206	Braille Keyboard Dot 6	Sel	<a href="#">23.4</a>
207	Braille Keyboard Dot 7	Sel	<a href="#">23.4</a>
208	Braille Keyboard Dot 8	Sel	<a href="#">23.4</a>
209	Braille Keyboard Space	Sel	<a href="#">23.4</a>
20A	Braille Keyboard Left Space	Sel	<a href="#">23.4</a>
20B	Braille Keyboard Right Space	Sel	<a href="#">23.4</a>
20C	<b>Braille Face Controls</b>	NAry	<a href="#">23.4</a>
20D	<b>Braille Left Controls</b>	NAry	<a href="#">23.4</a>
20E	<b>Braille Right Controls</b>	NAry	<a href="#">23.4</a>
20F	<b>Braille Top Controls</b>	NAry	<a href="#">23.4</a>
210	Braille Joystick Center	Sel	<a href="#">23.4</a>
211	Braille Joystick Up	Sel	<a href="#">23.4</a>
212	Braille Joystick Down	Sel	<a href="#">23.4</a>
213	Braille Joystick Left	Sel	<a href="#">23.4</a>

214	Braille Joystick Right	Sel	<a href="#">23.4</a>
215	Braille D-Pad Center	Sel	<a href="#">23.4</a>
216	Braille D-Pad Up	Sel	<a href="#">23.4</a>
217	Braille D-Pad Down	Sel	<a href="#">23.4</a>
218	Braille D-Pad Left	Sel	<a href="#">23.4</a>
219	Braille D-Pad Right	Sel	<a href="#">23.4</a>
21A	Braille Pan Left	Sel	<a href="#">23.4</a>
21B	Braille Pan Right	Sel	<a href="#">23.4</a>
21C	Braille Rocker Up	Sel	<a href="#">23.4</a>
21D	Braille Rocker Down	Sel	<a href="#">23.4</a>
21E	Braille Rocker Press	Sel	<a href="#">23.4</a>
21F-FFFF	<i>Reserved</i>		

Table 23.1: Braille Display Page

# 23.1 Braille Display Device

Usage Name	Usage Type	Description
<b>Braille Display</b>	CA	A device that is used by the visually impaired to read and/or write from a host computer.

## 23.2 Braille Cells

The Braille display consists of an array of individual cells. Each cell consists of either 6 or 8 *raised* or *not raised* dots. These controls are for the activation of individual dots.

Usage Name	Usage Type	Description
<b>Braille Row</b>	NARY	A row of contiguous braille cells ordered left to right. This collection contains braille cells and their corresponding router keys.
8 Dot Braille Cell	DV	A braille cell containing dots 1 through 8. Each cell contains a Braille pattern with 1 representing a raised dot and 0 a not raised dot. The pattern of dots used should be in accordance to ISO/TR 11548-1 Communication aids for blind persons <sup>1</sup> .
6 Dot Braille Cell	DV	A braille cell containing dots 1 through 6. Each cell contains a Braille pattern with 1 representing a raised dot and 0 a not raised dot. The pattern of dots used should be in accordance to ISO/TR 11548-1 Communication aids for blind persons <sup>1</sup> .
Number of Braille Cells	DV	Some braille displays dynamically reserve a portion of a braille row for display specific behavior, for example showing the progress of a file transfer. For example, a 20 cell display might reserve 4 cells. If this usage was set to 16, then cells 17 through 20 would be ignored by the braille display

<sup>1</sup><http://www.unicode.org/versions/Unicode5.2.0/ch15.pdf>

## 23.3 Routers

Each cell in a Braille display may have router buttons above or below it. They are typically used for moving the insertion cursor position. Some displays use a second row of router keys.

Typically these buttons perform actions on the item represented by the corresponding braille cell.

Usage Name	Usage Type	Description
<b>Router Set 1</b>	Nary	Primary router. Performs the same action as Button 1, Primary Button would perform with a pointer device.
<b>Router Set 2</b>	Nary	Secondary Router. Performs the same action as Button 2, Secondary Button would perform with a pointer device.
<b>Router Set 3</b>	Nary	Tertiary Router. Performs the same action as Button 3, Tertiary Button would perform with a pointer device.
Router Key	Sel	A router key above or below a braille cell. Ordered closest to the braille cell, to furthest away.
Row Router Key	Sel	A router key on the left or right side of a row of braille cells.

## 23.4 Braille Buttons

Usage Name	Usage Type	Description
<b>Braille Buttons</b>	NArY	Braille keyboards typically have 6 or 8 Buttons corresponding to Braille Dots 1-8, and a Space Bar used for braille input.
Braille Keyboard Dot 1	Sel	
Braille Keyboard Dot 2	Sel	
Braille Keyboard Dot 3	Sel	
Braille Keyboard Dot 4	Sel	
Braille Keyboard Dot 5	Sel	
Braille Keyboard Dot 6	Sel	
Braille Keyboard Dot 7	Sel	
Braille Keyboard Dot 8	Sel	
Braille Keyboard Space	Sel	
Braille Keyboard Left Space	Sel	
Braille Keyboard Right Space	Sel	
<b>Braille Face Controls</b>	NArY	A collection of controls located on the front face of a braille display. This collection contains Button Page or Braille Page usages as selectors.
<b>Braille Left Controls</b>	NArY	A collection of controls located on the left side of a braille display's cells. This collection contains Button Page or Braille Page usages as selectors.
<b>Braille Right Controls</b>	NArY	A collection of controls located on the right side of a braille display's cells. This collection contains Button Page or Braille Page usages as selectors.
<b>Braille Top Controls</b>	NArY	A collection of controls centered above the braille display's cells. This collection contains Button Page or Braille Page usages as selectors.
Braille Joystick Center	Sel	
Braille Joystick Up	Sel	
Braille Joystick Down	Sel	
Braille Joystick Left	Sel	
Braille Joystick Right	Sel	
Braille D-Pad Center	Sel	
Braille D-Pad Up	Sel	
Braille D-Pad Down	Sel	
Braille D-Pad Left	Sel	
Braille D-Pad Right	Sel	
Braille Pan Left	Sel	
Braille Pan Right	Sel	
Braille Rocker Up	Sel	
Braille Rocker Down	Sel	
Braille Rocker Press	Sel	



## 23.5 Screen Reader Control

Usage Name	Usage Type	Description
Screen Reader Control	Nary	Screen Reader specific functions. This collection contains usages from the Button usage page. Screen Reader Controls 1 through n are represented by Button page usages 1 through <i>n</i> , respectively.

## 23.6 Screen Reader Identifier

Usage Name	Usage Type	Description
Screen Reader Identifier	DV	<p>A 128 bit UUID identifying the active screen reader which is being interfaced with the Braille display. This identifier may be optionally observed by the braille display to infer the behavior of Screen Reader Controls.</p> <p>A screen reader would set this usage when interfacing with a braille display. Separately, as part of its documentation, the screen reader would document the UUID used to identify itself, as well as a list of screen reader functions which correspond to Screen Reader Controls 1 through <math>n</math>.</p> <p>If this identifier is 0, or unknown to the braille display, the braille display should assume that Screen Reader Controls are not supported by the screen reader.</p>

## 24 Lighting And Illumination Page (0x59)

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>LampArray</b>	CA	<a href="#">24.1</a>
02	<b>LampArrayAttributesReport</b>	CL	<a href="#">24.2</a>
03	LampCount	SV/DV	<a href="#">24.2</a>
04	BoundingBoxWidthInMicrometers	SV	<a href="#">24.2</a>
05	BoundingBoxHeightInMicrometers	SV	<a href="#">24.2</a>
06	BoundingBoxDepthInMicrometers	SV	<a href="#">24.2</a>
07	LampArrayKind	SV	<a href="#">24.2</a>
08	MinUpdateIntervalInMicroseconds	SV	<a href="#">24.2</a>
09-1F	<i>Reserved</i>		
20	<b>LampAttributesRequestReport</b>	CL	<a href="#">24.3</a>
21	LampId	SV/DV	<a href="#">24.3</a>
22	<b>LampAttributesResponseReport</b>	CL	<a href="#">24.3</a>
23	PositionXInMicrometers	DV	<a href="#">24.3</a>
24	PositionYInMicrometers	DV	<a href="#">24.3</a>
25	PositionZInMicrometers	DV	<a href="#">24.3</a>
26	LampPurposes	DV	<a href="#">24.3</a>
27	UpdateLatencyInMicroseconds	DV	<a href="#">24.3</a>
28	RedLevelCount	DV	<a href="#">24.3</a>
29	GreenLevelCount	DV	<a href="#">24.3</a>
2A	BlueLevelCount	DV	<a href="#">24.3</a>
2B	IntensityLevelCount	DV	<a href="#">24.3</a>
2C	IsProgrammable	DV	<a href="#">24.3</a>
2D	InputBinding	DV	<a href="#">24.3</a>
2E-4F	<i>Reserved</i>		
50	<b>LampMultiUpdateReport</b>	CL	<a href="#">24.4</a>
51	RedUpdateChannel	DV	<a href="#">24.4</a>
52	GreenUpdateChannel	DV	<a href="#">24.4</a>
53	BlueUpdateChannel	DV	<a href="#">24.4</a>
54	IntensityUpdateChannel	DV	<a href="#">24.4</a>
55	LampUpdateFlags	DV	<a href="#">24.4</a>
56-5F	<i>Reserved</i>		
60	<b>LampRangeUpdateReport</b>	CL	<a href="#">24.4</a>
61	LampIdStart	DV	<a href="#">24.4</a>
62	LampIdEnd	DV	<a href="#">24.4</a>
63-6F	<i>Reserved</i>		
70	<b>LampArrayControlReport</b>	CL	<a href="#">24.5</a>
71	AutonomousMode	DV	<a href="#">24.5</a>
72-FFFF	<i>Reserved</i>		

# 24.1 Application Usages

Usage Name	Usage Type	Description
LampArray	CA	Applied to a collection containing LampArray attributes and reports.

## 24.2 LampArray Attributes Report

Usage Name	Usage Type	Description
<b>LampArrayAttributesReport</b>	CL	Applied to a collection containing the device attributes of a LampArray.
LampCount	SV/DV	Number of Lamps associated with a LampArray (SV), or the number of Lamps being set in a LampMultiUpdateReport (DV).
BoundingBoxWidthInMicrometers	SV	Width (X axis) of a logical bounding-box encompassing the device. Must be a positive offset from the origin.
BoundingBoxHeightInMicrometers	SV	Height (Y axis) of a logical bounding-box encompassing the device. Must be a positive offset from the origin.
BoundingBoxDepthInMicrometers	SV	Depth (Z axis) of a logical bounding-box encompassing the device. Must be a positive offset from the origin.
LampArrayKind	SV	Kind of LampArray. Must be one of the values defined in <a href="#">Table 24.2.1 LampArrayKind Values</a>
MinUpdateIntervalInMicroseconds	SV	Minimal time interval required between the Host sending two updates for any one Lamp.

### 24.2.1 LampArrayKind Values

Name	Description	Value
<i>Undefined</i>	<i>Undefined</i>	00
LampArrayKindKeyboard	LampArray is part of a keyboard/keypad device	01
LampArrayKindMouse	LampArray is part of a mouse	02
LampArrayKindGameController	LampArray is part of a game-controller. (e.g. gamepad, flightstick, sailing simulation device)	03
LampArrayKindPeripheral	LampArray is part of a general peripheral/accessory (e.g. speakers, mousepad, microphone, webcam)	04
LampArrayKindScene	LampArray illuminates a room/performance-stage/area (e.g. room light-bulbs, spotlights, washlights, strobelights, booth-strips, billboard/sign, camera-flash)	05
LampArrayKindNotification	LampArray is part of a notification device	06
LampArrayKindChassis	LampArray is part of an internal PC case component (e.g. RAM-stick, motherboard, fan)	07
LampArrayKindWearable	LampArray is embedded in a wearable accessory (audio-headset, wristband, watch, shoes)	08
LampArrayKindFurniture	LampArray is embedded in a piece of furniture (e.g. chair, desk, bookcase)	09
LampArrayKindArt	LampArray is embedded in an artwork (e.g. painting, sculpture)	0A
<i>Reserved</i>	<i>Reserved</i>	0B-FFFF
Vendor-Defined	Vendor-Defined	10000-FFFFFFF

## 24.3 Lamp Attributes Report

Usage Name	Usage Type	Description
LampAttributesRequestReport	CL	Applied to a collection containing a LampId to request attributes for.
LampAttributesResponseReport	CL	Applied to a collection containing attributes corresponding to a requested LampId.
LampId	SV/DV	Id of a Lamp. Valid range is between 0 and (LampCount - 1). (SV) if in a LampAttributesReport, (DV) if in a Lamp*UpdateReport
PositionXInMicrometers	DV	X position (corresponding to Bounding Box Width) from origin
PositionYInMicrometers	DV	Y position (corresponding to Bounding Box Height) from origin
PositionZInMicrometers	DV	Z position (corresponding to Bounding Box Depth) from origin
LampPurposes	DV	Purpose/s of a Lamp. Must be one or more flags from table in <a href="#">Table 24.3.1 LampPurposes Flags</a>
UpdateLatencyInMicroseconds	DV	Time interval between the device receiving an update for a Lamp and it emanating from the device.
RedLevelCount	DV	The number of red color intensities settable for this LampId.
GreenLevelCount	DV	The number of green color intensities settable for this LampId.
BlueLevelCount	DV	The number of blue color intensities settable for this LampId.
IntensityLevelCount	DV	The number of color independent intensities settable for this LampId.
IsProgrammable	DV	1 if this Lamp has programmable colors, 0 if it doesn't.
InputBinding	DV	Keyboard* Usages from <a href="#">Section 10 Keyboard/Keypad Page (0x07)</a> or Button* Usages from <a href="#">Section 12 Button Page (0x09)</a>

### 24.3.1 LampPurposes Flags

*Note: Flags are permitted to be combined. Lacking any flags for this field (i.e. 0) is undefined.*

Name	Description	Value
LampPurposeControl	Control Lamp (e.g. button/key/slider etc...)	01
LampPurposeAccent	Accent Lamp that doesn't interact with the user (e.g. case fan LED, illuminated side panels on a keyboard)	02
LampPurposeBranding	Device branding (e.g. Manufacturer logo)	04
LampPurposeStatus	Status Lamp (e.g. unread email, CPU temperature)	08
LampPurposeIllumination	Illuminates an object that is outside of the LampArray (e.g. stage spotlight, car headlights, camera flash)	10
LampPurposePresentation	A Lamp the user directly looks at (e.g. within an artwork or costume)	20
<i>Reserved</i>	<i>Reserved</i>	40-FFFF
Vendor Defined	Vendor Defined	10000-FFFFFFFF

## 24.4 Lamp Update Reports

Usage Name	Usage Type	Description
<b>LampMultiUpdateReport</b>	CL	Applied to a collection containing updates for multiple Lamps, each Lamp specified can have a different color.
<b>LampRangeUpdateReport</b>	CL	Applied to a collection containing a single range update consisting of color channels and LampIdStart/LampIdEnd. All Lamps within range are set to the same color.
RedUpdateChannel	DV	Flags associated with a Lamp*Update message. See Table <a href="#">24.4.1 LampUpdate Flags</a>
GreenUpdateChannel	DV	Red intensity of the new color for this LampId. Ignored unless Lamp IsProgrammable is true.
BlueUpdateChannel	DV	Green intensity of the new color for this LampId. Ignored unless Lamp IsProgrammable is true.
IntensityUpdateChannel	DV	Blue intensity of the new color for this LampId. Ignored unless Lamp IsProgrammable is true.
LampUpdateFlags	DV	Intensity/gain overall of the new color for this LampId.
LampIdStart	DV	The first LampId in the range of LampIds to update.
LampIdEnd	DV	The last LampId in the range of LampIds to update.

### 24.4.1 LampUpdate Flags

Name	Description	Value
LampUpdateComplete	Signals that this was the last update in a batch of updates. Device should now process all preceeding messages as a single update to Lamp state.	01
<i>Reserved</i>	<i>Reserved</i>	02-FFFF

## 24.5 LampArray Control Report

Usage Name	Usage Type	Description
<b>LampArrayControlReport</b>	CL	Applied to a collection containing LampArray control fields.
AutonomousMode	DV	Boolean value indicating whether the device can set Lamp state itself/autonomously (i.e. without the Host sending Lamp update messages). Default value is enabled/true.



## 24.6 LampArray Operation

Typical LampArray operation has several phases;-

- Interrogation of LampArray device attributes.
- Interrogation of individual Lamp attributes.
- Disabling AutonomousMode on the device.
- Updating Lamp state.
- Enabling AutonomousMode on the device.

While it is not required that these phases are done in order (and no device should ever assume it), as we outline below, it should be clear that this is the most reasonable practice for a Host. See Figure [LampArray Operation](#).

*Note: Retrieval of Lamp colour state is not outlined since state is controlled exclusively by the Host which always knows the state it last set the device to. Future additions to this specification may include setting persistent state and its retrieval.*

- Distance measurements to be given in micrometers ( $\mu\text{m}$ ). For a signed 32bit integer (largest supported by HID), this gives a range from  $1\ \mu\text{m}$  to  $>2\text{km}$ , which seems sufficient to describe any device.
- Time measurements to be given in microseconds ( $\mu\text{s}$ ). For a signed 32bit integer (largest supported by HID), this gives a range from  $1\ \mu\text{s}$  to  $>30\text{minutes}$

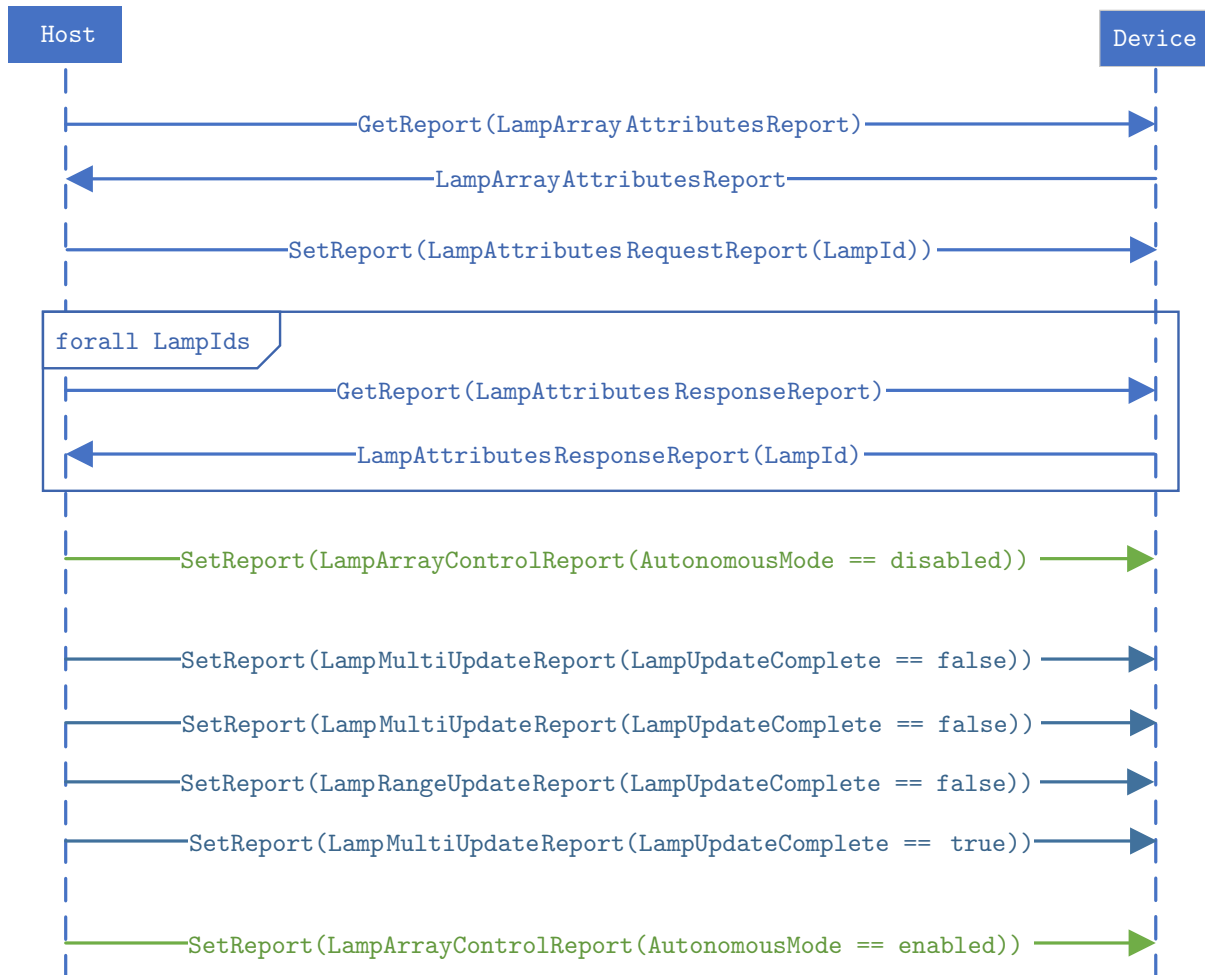


Figure 24.1: LampArray Operation

## 24.7 LampArray Attributes and Interrogation

Every `LampArray` is expected to have attributes describing the physical device that contains the `LampArray`. This includes the number of Lamps (`LampCount`), the kind of `LampArray` and dimensions of a logical bounding box. These values are static and can never change. `LampArrayAttributesReport` is used to retrieve these attributes.

`LampArrayKind` describes the type of physical device that contains the `LampArray` (e.g. keyboard/mouse/gamecontroller...). This helps the Host know what Lamp Attributes it can expect and associate it with other HID devices (keyboard/mouse). The kind must use one of `LampArrayKind*` values from Table 24.2.1 `LampArrayKind Values`.

`BoundingBox*InMicrometers` describes a logical box encompassing the physical device. Origin (0,0,0) is that of the right-hand coordinate system (as prescribed in the HID spec 5.9 Orientation<sup>1</sup>) which denotes the upmost, farthest, left-hand corner of the box. This box is used to provide the bounds of the device (without the detail/complexity of a true 3D model) and to provide a reference origin for Lamp coordinates. All sizes/coordinates/positions are thus positive offsets from this origin.

The dimensions and coordinate system is illustrated below with a typical keyboard and mouse in Figure 24.2, Figure 24.3 respectively.

In particular, notice:-

- Width is always perpendicular to the user when this keyboard/mouse is naturally orientated.
- Origin (0,0,0) is not flush with the corner of the keyboard as the device has a curved rise in the middle.
- Origin (0,0,0) is nowhere near the mouse body.



Figure 24.2: Keyboard with labeled dimensions and origin. Lamps exist beneath every key, the branding at the top/middle, and accent lighting along the left and right sides. Example sizes given for each dimension (in  $\mu\text{m}$ ).

<sup>1</sup>[https://usb.org/sites/default/files/documents/hid1\\_11.pdf](https://usb.org/sites/default/files/documents/hid1_11.pdf)

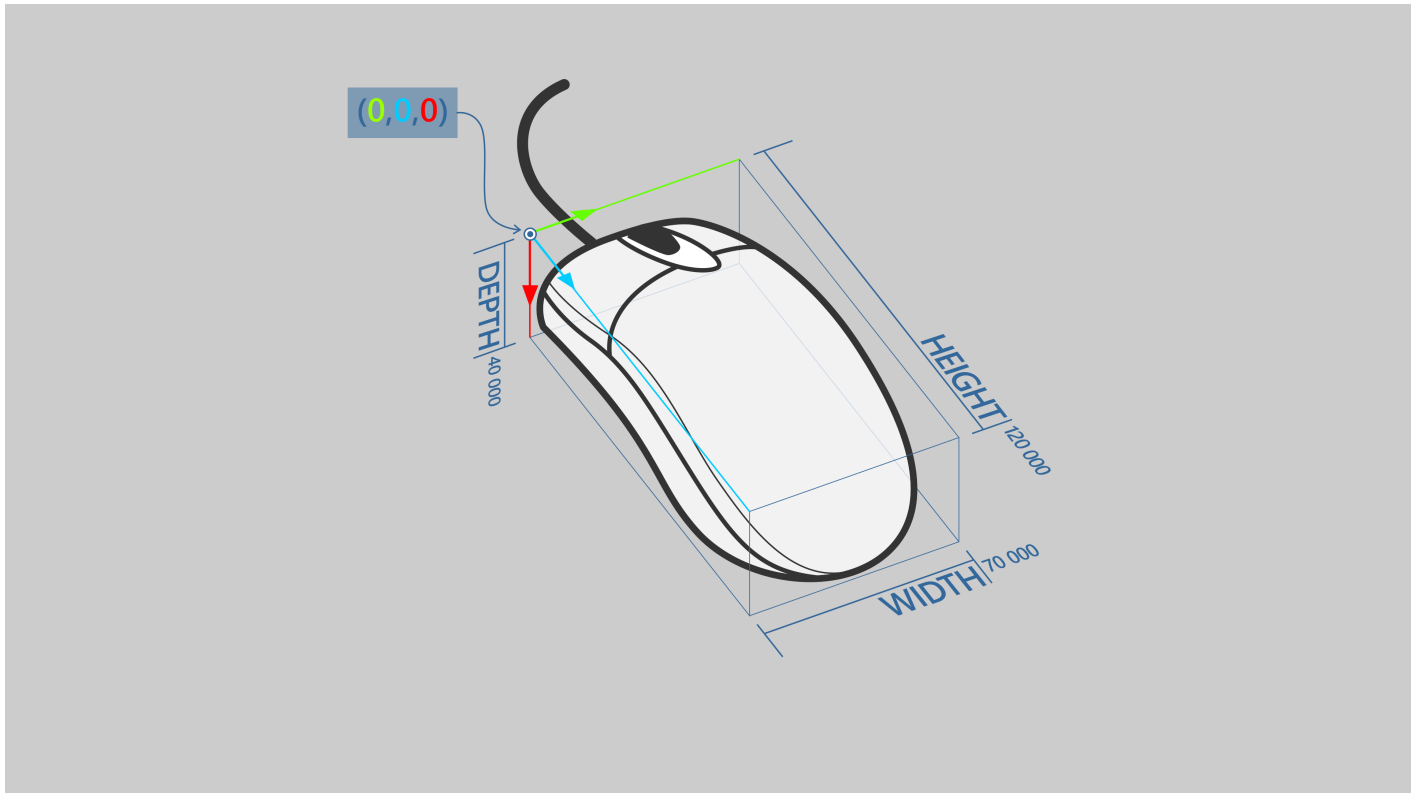


Figure 24.3: Mouse with labeled dimensions and origin. Example sizes given for each dimension (in  $\mu\text{m}$ ).

`MinUpdateIntervalInMicroseconds` is the minimal time interval required for the Host to wait before sending two updates for any one Lamp. This is to prevent the Host overwhelming the device by sending too many `Lamp*UpdateReports` too quickly. A device must be able to accommodate updating every Lamp (individually) before requiring the Host to wait for the interval. This means a device must be able to receive and process (consecutively) the minimum number of `LampMultiUpdateReports` required to update all Lamps. This is so the Host knows it can update every Lamp on the device before waiting for the interval. If a Host misbehaves and sends more reports than allowed before waiting for the interval, the device can ignore those reports.

For example, a device where `LampArrayAttributes:LampCount==40` and `LampMultiUpdate:LampCount==8`, requires a minimum of  $(40/8=5)$  `LampMultiUpdateReports`; so 5 reports must be accepted before the Host is required to wait the interval.

## 24.8 Lamp Attributes and Interrogation

### 24.8.1 LampAttributesRequestReport

Having retrieved the LampCount, interrogation of a Lamp begins by the Host sending a LampAttributesRequestReport (via SetReport) with the LampId of the first Lamp to interrogate. Each Lamp must have a unique LampId, numbered from 0 to LampCount-1 (inclusive). Lamps without a LampId cannot be referenced and must not be included in the LampArray. An invalid LampId, must be treated by the device as LampId==0.

It is recommended that LampIds are assigned to Lamps in a methodical manner (e.g. grid, starting from top-left) to take the most advantage of the LampRangeUpdateReport described below. This can significantly reduce traffic overhead of the update.

### 24.8.2 LampAttributesResponseReport

The Host then requests a LampAttributesResponseReport (via GetReport) to which the device returns the attributes of the previously requested LampId.

Upon a successful response, the device will automatically (and internally) increment the previously sent LampId such that the next time the Host sends a LampAttributesResponseReport, the device will return the attributes of the LampId+1 Lamp. Further requests monotonically increase the previous LampId.

After LampId==LampCount-1, the device will reset the internal LampId to 0, and continue to monotonically increase after each successful response. In this way a Host need only send a single LampAttributesRequestReport for the first LampId to inspect (e.g. 0), then request multiple LampAttributesResponseReports; one for each further Lamp to inspect. Alternatively, a Host can explicitly send a LampAttributesRequestReport before each LampAttributesResponseReport instead of taking advantage of the automatic device increment; or a mix of the two patterns.

The default internal LampId is 0.

The Host must always check the LampId of the returned report to ensure it was expected (as an invalid LampId will always be treated as LampId==0)

#### 24.8.2.1 Example

Sample operations of LampArray with 6 Lamps. Observe (#1-8) how the Host sets the LampId and then can receive multiple Response reports where the LampId increments by 1 each time until it resets to 0. Additionally see (#9-14) that the Host can still explicitly request which Lamp it should receive attributes for (e.g. if the Host wishes to request Lamps out of order).

#	ReportType	Direction	LampId
1	LampAttributesRequestReport	OUT	0
2	LampAttributesResponseReport	IN	0
3	LampAttributesResponseReport	IN	1
4	LampAttributesResponseReport	IN	2
5	LampAttributesResponseReport	IN	3
6	LampAttributesResponseReport	IN	4
7	LampAttributesResponseReport	IN	5
8	LampAttributesResponseReport	IN	0
9	LampAttributesRequestReport	OUT	2
10	LampAttributesResponseReport	IN	2
11	LampAttributesRequestReport	OUT	4
12	LampAttributesResponseReport	IN	4
13	LampAttributesResponseReport	IN	5
14	LampAttributesResponseReport	IN	0

### 24.8.3 Lamp Attributes

All Lamp attributes are static and can never change across device resets or external events.

PositionX/Y/Z describes the location of the Lamp (in 3D space) relative to the bounding-box origin defined in 24.7. Such data is useful for the Host when creating effects (e.g. animation moving from left to right). All Lamps are assumed to be a single, dimensionless point of zero size.

LampPurposes identifies the high-level purpose/s of the Lamp. This helps the Host determine what scenarios the Lamp can be used. The value must be composed of one or more LampPurposes\* flags described in the Table 24.3.1 LampPurposes Flags .

In the figures below we can see Lamps with different LampPurposes labeled with example X/Y/Z positions.

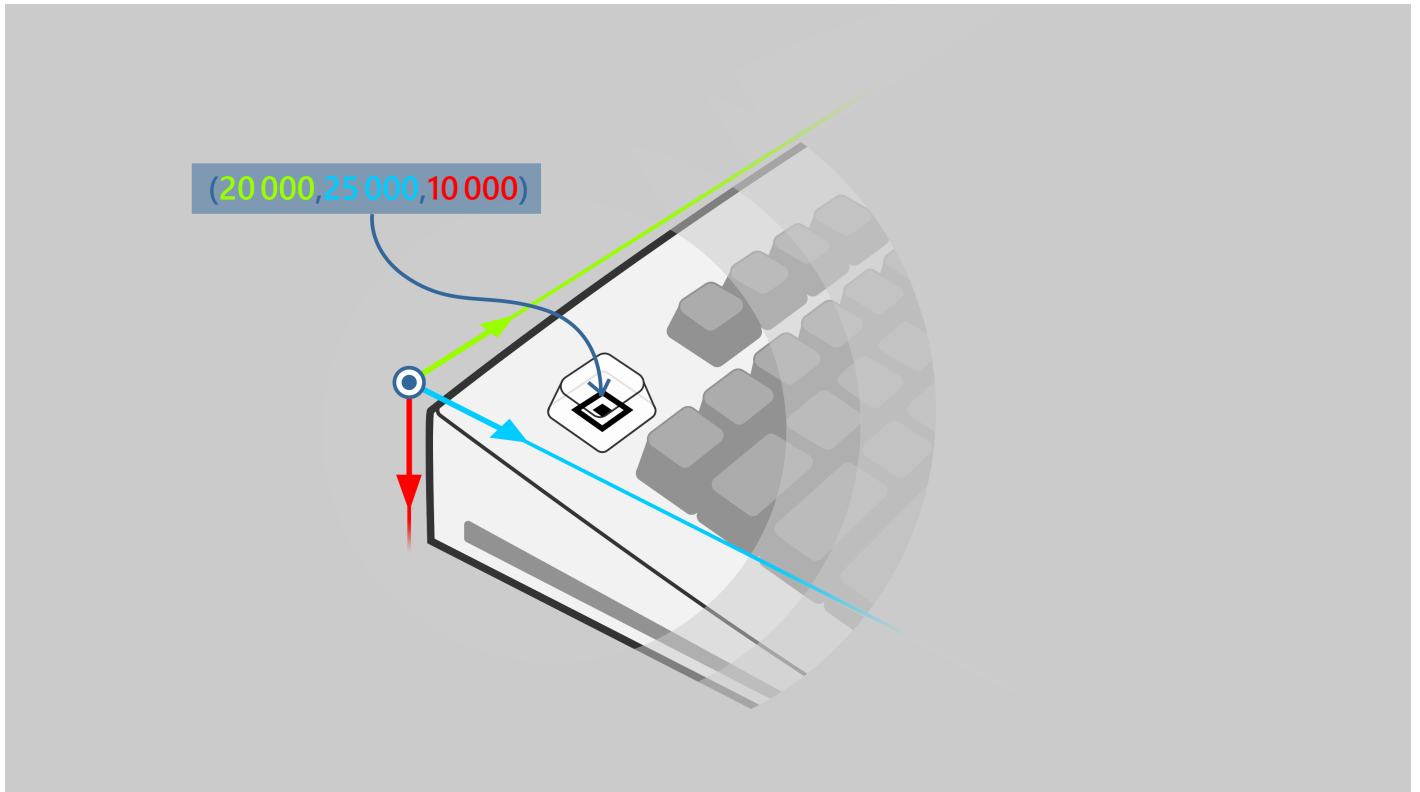


Figure 24.4: Keyboard control lamp under the esc key. Position of lamp relative to the bounding box (described above) labeled in  $\mu\text{m}$ .



Figure 24.5: Keyboard branding lamp under the logo. Position of lamp relative to the bounding box (described above) labeled in  $\mu\text{m}$ .

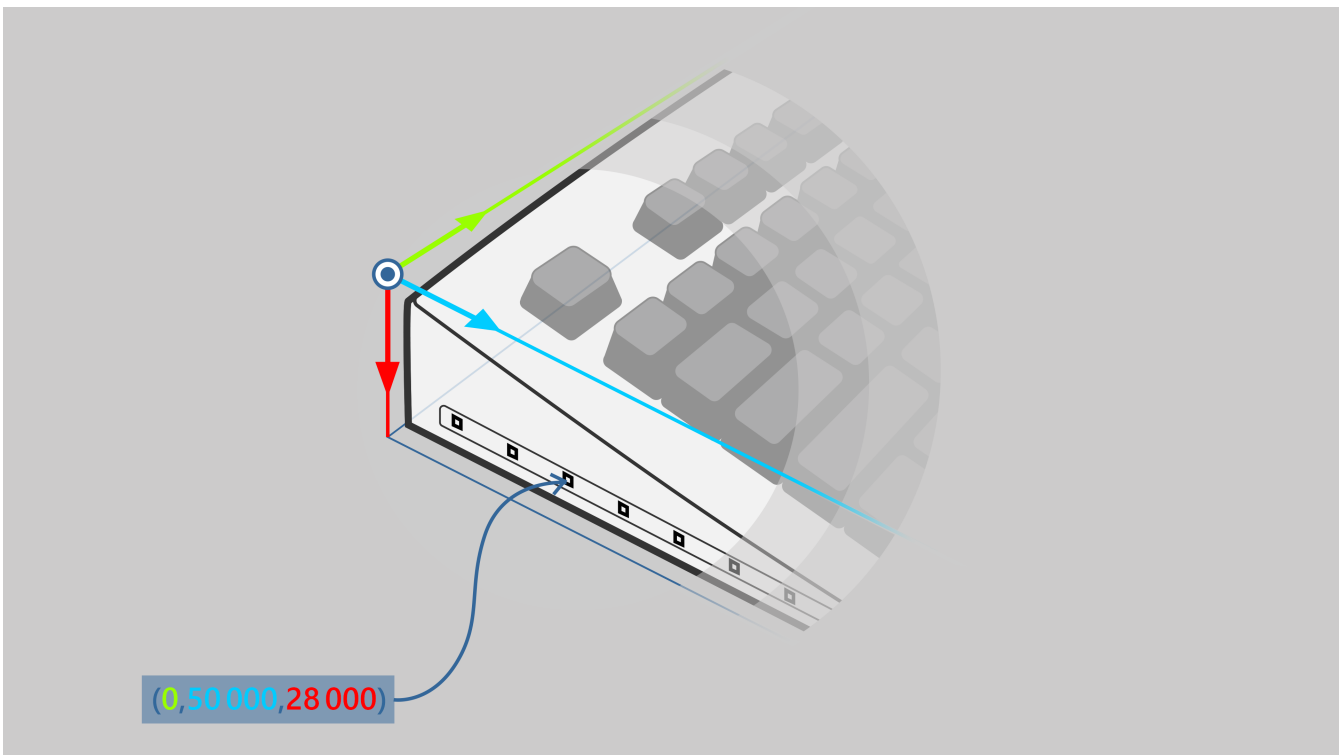


Figure 24.6: Accent lamp on the LHS (part of accent lighting). Position of lamp relative to the bounding box (described above) labeled in  $\mu\text{m}$ .

`UpdateLatencyInMicroseconds` describes the smallest time interval between a device receiving a `Lamp*UpdateReport` and the state emanating from the device. This includes the time spent processing the report and the update latency of the specific `Lamp` (e.g. LEDs switch faster than incandescent lamps). This must be determined by the manufacturer and an upper bound given from a `Lamp` being completely off to any color intensity. This allows a `Host` to coordinate effects between multiple devices. It is expected (though not required) that this value will be identical for all `Lamps` of the same electrical/mechanical type on a device.

`InputBinding` associates a `Lamp` with either a keyboard/keypad key or a mouse button. This is to support today's common case of keyboards/mice with individually backlit keys/buttons. If the `LampArrayKind` declares the device as a keyboard, `InputBinding` must use one of the unsigned 16bit `Keyboard*` Usages from the [Keyboard/Keypad Page \(0x07\)](#). If declared as a mouse, `InputBinding` must use one of the unsigned 16bit `Button*` Usages from the [Button Page \(0x09\)](#) in the range of `Button1 (0x01)` to `Button5 (0x05)` inclusive. No more than 5 buttons are supported for any mouse.

If a key/button is not associated with this `Lamp` or it is not declared as either a keyboard or mouse, this value must be 0; non-zero values must be ignored by the `Host`.

## 24.9 Color Attributes

LampArrays support both FixedColor and Programmable Lamps. For Programmable Lamps (indicated by IsProgrammable==1), \*LevelCount values indicate the levels of intensity supported by the red, green, and blue color channels, each of which can be varied independently. Zero indicates an *off* state, and non-zero values indicate varying levels of color intensity. For example:

- A value of zero indicates that the color channel is not supported.
- A value of one indicates that the only intensities supported for the color channel are fully on and fully off.
- A value of 10 indicates that ten levels of intensity are supported, in addition to being turned off.

The highest non-zero intensity level corresponds to the maximum possible brightness for that color channel. Intensity values map as closely as possible to a visually linear brightness curve.

IntensityLevelCount indicates how many levels of overall intensity are supported for a Lamp. Zero indicates an *off* state, and non-zero values indicate varying levels of overall intensity/gain for a Lamp. Any number of intensity levels >1 is supported. The highest non-zero intensity value corresponds to unity gain (maximum intensity), with intermediate values describing relative linear gain.

FixedColor Lamps (IsProgrammable==0) have a single fixed color at maximum intensity described by the relative color intensities of RedLevelCount, GreenLevelCount, BlueLevelCount. IntensityLevelCount can optionally be described (to vary overall intensity), but minimally most support 0 (off), 1 (on); intermediate intensity levels are scaled.

### 24.9.1 Color Attributes Examples

The table below illustrates examples of programmable Lamps, and how they are expressed via RedLevelCount, GreenLevelCount, BlueLevelCount, IntensityLevelCount.

Red	Green	Blue	Intensity	Meaning
1	1	0	1	A lamp that can be red, yellow, or green. The only intensities available are on or off.
1	0	1	32	A lamp that can be red, blue, or purple. The overall intensity of the lamp can be set to one of 32 levels, but the relative intensity of the red/blue channels cannot.
16	16	0	1	A red/green lamp that supports 256 unique colors.
255	255	255	1	An RGB lamp that supports 16,777,216 unique colors.



## 24.10 LampArrayControlReport

This report is defined to control various device-wide settings. All settings are non-persistent unless explicitly marked.

### 24.10.1 AutonomousMode

`AutonomousMode` is a boolean field indicating whether the device can decide whether/how to update Lamps itself, or if the Host has the exclusive ability to set/update the Lamp state. No source other than the Host can modify Lamp state while field is disabled/false. When enabled/true, the Lamp state can be set by other sources (e.g. Lamp state set manually on device or reverts to an embedded default effect) and any `Lamp*UpdateReports` can be ignored. Default state for this field is enabled/true. The device must always handle `LampArrayAttributesReports`, `LampAttributesRequestReports`, `LampAttributesResponseReports`, regardless of this field state.

When disabled, only the Host may change the Lamp state (via `Lamp*UpdateReports`). Once disabled (and was previously enabled, but before sending `Lamp*UpdateReports`) the device must *pause* any playing effect it started and maintain Lamps to whatever was last set by the device (e.g. if displaying solid blue in autonomous mode, once disabled, solid blue must persist). If the field was previously enabled (and is set to enabled again), it is a no-op. Similarly, disabling when already disabled is a no-op.

After the field is disabled, sent `Lamp*UpdateReports` will change the Lamp state from the last device-set state. It is up to the Host to *override* the persisted state by sending `Lamp*UpdateReports`. The Host with guarantee to wait for `MinUpdateIntervalInMicroseconds` before sending its first `Lamp*UpdateReport`.

If this field is absent, it means no autonomous mode is supported. If supported, the device should default to enabled/true.

## 24.11 Updating Lamp State

Two reports are defined (**LampMultiUpdateReport**, **LampRangeUpdateReport**) to accommodate expected classes of updates. Both updates are non-persistent, such that if a device loses power, or is moved to a different **Host**, the **Lamp** returns to its default state. Default state for all **Lamps** is *off* (RGBI=0,0,0,0).

Update reports can contain flags (**LampUpdateFlags**) to describe the update; currently, **LampUpdateComplete** is the only valid flag. **LampUpdateComplete** is set by the **Host** when the report is the last update in a batch of updates, and the device should alter the **Lamp** states all at once. Devices can wait until an update with this flag has been received before applying any of the previous updates. The **Host** guarantees to not send more than 1 update with this flag every **MinUpdateIntervalInMicroseconds**.

### 24.11.1 LampMultiUpdateReport

**LampMultiUpdateReport** updates the color of multiple **Lamps** in a single request, where all four channels (Red/Green/Blue/Intensity) can be set at once for given **Lamps**. The **MaxLogicalSize** of the **LampCount** Usage in the descriptor defines the number of available update-slots. Within the report, **LampCount** identifies the number of update slots to be examined (starting from the first slot). **LampIds** do not have to be ordered (e.g. ascending), but update-slot position identifies corresponding RGBI tuple. Update-slots must always be filled from 0 to **max(LampCount)**. Any unused slot must be ignored by the device. (It is recommended the **Host** set both the **LampId** and the corresponding channel intensities to 0).

For **FixedColor Lamps**, only the **Intensity** channel is examined by the device (i.e. Red/Green/Blue channels are always ignored; as a best practice these channels should always be set to 0 by the **Host**).

If any error is detected by the device in the report, the device shall ignore the entire report. Errors include:-

- Any **LampId**  $\geq$  Device **LampCount**
- $\ast$ Channel  $>$   $\ast$ LevelCount described by **Lamps'** attributes. (e.g. if a **Lamp** had **RedLevelCount**=100 and an update set the channel to 101)
- Identical **LampId** in multiple slots.

*Note: In the example below is a **LampMultiUpdateReport** which has 8 update slots and declares it has 5 **Lamps** to update; slots 6/7/8 are hence ignored by the device. **LampId**#1 (0x19) corresponds to RGBI tuple #1 (FF 00 FF 80) etc...*

LampCount	0x05
LampId #1	0x19
LampId #2	0x23
LampId #3	0x72
LampId #4	0x56
LampId #5	0x64
LampId #6	ignored
LampId #7	ignored
LampId #8	ignored
RGBI tuple #1	0xFF 0x00 0xFF 0x80
RGBI tuple #2	0x80 0x80 0xFF 0xFF
RGBI tuple #3	0x00 0x00 0x80 0xFF
RGBI tuple #4	0xFF 0x80 0x00 0x80
RGBI tuple #5	0xFF 0xFF 0x00 0xFF
RGBI tuple #6	ignored
RGBI tuple #7	ignored
RGBI tuple #8	ignored

## 24.11.2 LampRangeUpdateReport

LampRangeUpdateReport allows multiple Lamps to be updated based on the range between two LampIds. LampIdStart and LampIdEnd are both included in the range. The single Red/Green/Blue/Intensity color is applied to every Lamp within the range. A common use-case for range to turn all Lamps *off* (LampIdStart==0, LampIdEnd==(LampCount-1), RGBI==0).

For FixedColor Lamps, Red/Green/Blue channels are always ignored.

If any error is detected by the device in the report, the device shall ignore the entire report. Errors include:-

- LampIdStart >LampIdEnd
- LampIdStart OR LampIdEnd >= Device LampCount
- \*Channel >\*LevelCount described by any Lamps' attributes within the range. (i.e. The Host must ensure all Lamps in the described range support the desired channel intensities)

FixedColor Lamps may be mixed with Programmable Lamps within the range so long as the desired IntensityUpdateChannel is within range. RGB channels for FixedColor Lamps will be ignored.

*Note: In the example below, all Lamps between (and including) LampId=0x19 to LampId=0x31 are set to the corresponding RGBI value (0xFF 0x00 0x00 0xFF).*

LampIdStart	0x19
LampIdEnd	0x31
RGBI tuple	0xFF 0x00 0x00 0xFF

## 25 Camera Control Page (0x90)

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01-1F	<i>Reserved</i>		
20	Camera Auto-focus [21]	OSC	<a href="#">25.1</a>
21	Camera Shutter [21]	OSC	<a href="#">25.1</a>
22-FFFF	<i>Reserved</i>		

Table 25.1: Camera Control Page

## 25.1 Camera Controls

Usage Name	Usage Type	Description
Camera Auto-Focus	OSC	Activate the camera auto-focus.
Camera Shutter	OSC	Capture a still picture or start/stop video recording.

## 26 Gaming Device Page (0x92)

The *Gaming Standards Association* (GSA) has been given this page for *itself*, to be used by implementer's of it's own standard for USB gaming peripherals.

<https://www.gamingstandards.com/>

## 27 FIDO Alliance Page (0xF1D0)

The FIDO (Fast Identify Online) Alliance page provides usage definitions for devices that include Authentication features compliant with FIDO Alliance standards. The specification is available on the FIDO Alliance website<sup>1</sup>.

Usage ID	Usage Name	Usage Types	Section
00	<i>Undefined</i>		
01	<b>U2F Authenticator Device</b>	CA	<a href="#">27.1</a>
02-1F	<i>Reserved</i>		
20	Input Report Data	DV	<a href="#">27.1</a>
21	Output Report Data	DV	<a href="#">27.1</a>
22-FFFF	<i>Reserved</i>		

Table 27.1: Fast Identity Online Alliance Page

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<sup>1</sup><https://fidoalliance.org/specs/fido-u2f-v1.0-ps-20141009/fido-u2f-hid-protocol-ps-20141009.html>

## 27.1 Application Usages

Usage Name	Usage Type	Description
U2F Authenticator Device	CA	A device that provides 2nd factor authentication using the FIDO U2FHID protocol.
Input Data Report	DV	Device <i>response</i> data compliant with U2FHID Protocol specification.
Output Data Report	DV	Device <i>request</i> data compliant with U2FHID Protocol specification.



# A Indices for 8bit Preferred Colors

Index	Name	RGB Values
0	AliceBlue	F0F8FF
1	AntiqueWhite	FAEBD7
2	Aqua	00FFFF
3	Aquamarine	7FFFD4
4	Azure	F0FFFF
5	Beige	F5F5DC
6	Bisque	FFE4C4
7	Black	000000
8	BlanchedAlmond	FFEBCD
9	Blue	0000FF
10	BlueViolet	8A2BE2
11	Brown	A52A2A
12	BurlyWood	DEB887
13	CadetBlue	5F9EA0
14	Chartreuse	7FFF00
15	Chocolate	D2691E
16	Coral	FF7F50
17	CornflowerBlue	6495ED
18	Cornsilk	FFF8DC
19	Crimson	DC143C
20	Cyan	00FFFF
21	DarkBlue	00008B
22	DarkCyan	008B8B
23	DarkGoldenRod	B8860B
24	DarkGray	A9A9A9
25	DarkGreen	006400
26	DarkKhaki	BDB76B
27	DarkMagenta	8B008B
28	DarkOliveGreen	556B2F
29	DarkOrange	FF8C00
30	DarkOrchid	9932CC
31	DarkRed	8B0000
32	DarkSalmon	E9967A
33	DarkSeaGreen	8FBC8F
34	DarkSlateBlue	483D8B
35	DarkSlateGray	2F4F4F
36	DarkTurquoise	00CED1
37	DarkViolet	9400D3
38	DeepPink	FF1493
39	DeepSkyBlue	00BFFF
40	DimGray	696969
41	DodgerBlue	1E90FF

42	FireBrick	B22222
43	FloralWhite	FFFAF0
44	ForestGreen	228B22
45	Fuchsia	FF00FF
46	Gainsboro	DCDCDC
47	GhostWhite	F8F8FF
48	Gold	FFD700
49	GoldenRod	DAA520
50	Gray	808080
51	Green	008000
52	GreenYellow	ADFF2F
53	HoneyDew	F0FFF0
54	HotPink	FF69B4
55	IndianRed	CD5C5C
56	Indigo	4B0082
57	Ivory	FFFFF0
58	Khaki	F0E68C
59	Lavender	E6E6FA
60	LavenderBlush	FFF0F5
61	LawnGreen	7CFC00
62	LemonChiffon	FFFACD
63	LightBlue	ADD8E6
64	LightCoral	F08080
65	LightCyan	E0FFFF
66	LightGoldenRodYellow	FAFAD2
67	LightGray	D3D3D3
68	LightGreen	90EE90
69	LightPink	FFB6C1
70	LightSalmon	FFA07A
71	LightSeaGreen	20B2AA
72	LightSkyBlue	87CEFA
73	LightSlateGray	778899
74	LightSteelBlue	B0C4DE
75	LightYellow	FFFFE0
76	Lime	00FF00
77	LimeGreen	32CD32
78	Linen	FAF0E6
79	Magenta	FF00FF
80	Maroon	800000
81	MediumAquaMarine	66CDAA
82	MediumBlue	0000CD
83	MediumOrchid	BA55D3
84	MediumPurple	9370DB
85	MediumSeaGreen	3CB371
86	MediumSlateBlue	7B68EE

87	MediumSpringGreen	00FA9A
88	MediumTurquoise	48D1CC
89	MediumVioletRed	C71585
90	MidnightBlue	191970
91	MintCream	F5FFFA
92	MistyRose	FFE4E1
93	Moccasin	FFE4B5
94	NavajoWhite	FFDEAD
95	Navy	000080
96	OldLace	FD5E6
97	Olive	808000
98	OliveDrab	6B8E23
99	Orange	FFA500
100	OrangeRed	FF4500
101	Orchid	DA70D6
102	PaleGoldenRod	EEE8AA
103	PaleGreen	98FB98
104	PaleTurquoise	AFEEEE
105	PaleVioletRed	DB7093
106	PapayaWhip	FFED5
107	PeachPuff	FFDAB9
108	Peru	CD853F
109	Pink	FFC0CB
110	Plum	DDA0DD
111	PowderBlue	B0E0E6
112	Purple	800080
113	RebeccaPurple	663399
114	Red	FF0000
115	RosyBrown	BC8F8F
116	RoyalBlue	4169E1
117	SaddleBrown	8B4513
118	Salmon	FA8072
119	SandyBrown	F4A460
120	SeaGreen	2E8B57
121	SeaShell	FFF5EE
122	Sienna	A0522D
123	Silver	C0C0C0
124	SkyBlue	87CEEB
125	SlateBlue	6A5ACD
126	SlateGray	708090
127	Snow	FFFAFA
128	SpringGreen	00FF7F
129	SteelBlue	4682B4
130	Tan	D2B48C
131	Teal	008080

132	Thistle	D8BFD8
133	Tomato	FF6347
134	Turquoise	40E0D0
135	Violet	EE82EE
136	Wheat	F5DEB3
137	White	FFFFFF
138	WhiteSmoke	F5F5F5
139	Yellow	FFFF00
140	YellowGreen	9ACD32
141-254	<i>Reserved</i>	
255	No Preferred Color	

# References

- [1] HUTRR28, Gaming Standards Associated UsagePage Reservation, 2005, [https://www.usb.org/sites/default/files/hutrr28\\_-\\_gsa\\_usage\\_page\\_0.pdf](https://www.usb.org/sites/default/files/hutrr28_-_gsa_usage_page_0.pdf)
- [2] HUTRR29, Repurposing Alphanumeric Display Page As Generic Auxiliary Display Page, 2004, [https://www.usb.org/sites/default/files/hutrr29b\\_0.pdf](https://www.usb.org/sites/default/files/hutrr29b_0.pdf)
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