HID Usage Tables

FOR

Universal Serial Bus (USB)

Version 1.5

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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
Application	A software program that consumes the data generated by the HID device **Input** reports, or that controls the HID device through **Feature** or **Output** reports. Applications can be games or other programs used by end users or system software components.
Array field	The bit field created by an **Input**, **Output**, or **Feature** main item which is declared as an **Array**. An array field contains the index of a Usage, not the Usage value.
Control	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.
Field	The **Input**, **Output**, and **Feature** main items create a bit field in a report. The **Report Size** 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.
Pad	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. *Note: Fields created by **Main** 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.*
Usage	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	*Undefined*	
01	Generic Desktop Page (0x01)	4
02	Simulation Controls Page (0x02)	5
03	VR Controls Page (0x03)	6
04	Sport Controls Page (0x04)	7
05	Game Controls Page (0x05)	8
06	Generic Device Controls Page (0x06)	9
07	Keyboard/Keypad Page (0x07)	10
08	LED Page (0x08)	11
09	Button Page (0x09)	12
0A	Ordinal Page (0x0A)	13
0B	Telephony Device Page (0x0B)	14
0C	Consumer Page (0x0C)	15
0D	Digitizers Page (0x0D)	16
0E	Haptics Page (0x0E)	17
0F	Physical Input Device Page (0x0F)	18
10	Unicode Page (0x10)	19
11	SoC Page (0x11)	20
12	Eye and Head Trackers Page (0x12)	21
13-13	*Reserved*	
14	Auxiliary Display Page (0x14)	22
15-1F	*Reserved*	
20	Sensors Page (0x20)	23
21-3F	*Reserved*	
40	Medical Instrument Page (0x40)	24
41	Braille Display Page (0x41)	25
42-58	*Reserved*	
59	Lighting And Illumination Page (0x59)	26
5A-7F	*Reserved*	
80	Monitor Page (0x80)	27
81	Monitor Enumerated Page (0x81)	28
82	VESA Virtual Controls Page (0x82)	29
83-83	*Reserved*	
84	Power Page (0x84)	30
85	Battery System Page (0x85)	31
86-8B	*Reserved*	
8C	Barcode Scanner Page (0x8C)	32

8D	Scales Page (0x8D)	33
8E	Magnetic Stripe Reader Page (0x8E)	34
8F-8F	*Reserved*	
90	Camera Control Page (0x90)	35
91	Arcade Page (0x91)	36
92	Gaming Device Page (0x92)	37
93-F1CF	*Reserved*	
F1D0	FIDO Alliance Page (0xF1D0)	38
F1D1-FEFF	*Reserved*	
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 $-n$ decrements the value, $+n$ increments it, and no change occurs when 0 is asserted. A jog wheel control is implemented with a resolution of $+/-n$, 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 a 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
Primary Language ID 0xFF (HID)										**Sublanguage ID** 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**
`bmRequestType`	0	1	Device to Host, Standard, Device	10000000B
`bRequest`	1	1	`GET_DESCRIPTOR`	0x06
`wValue` (High)	2	1	`STRING_DESCRIPTOR`	0x03
`wValue` (Low)	3	1	String Index	0x03
`wIndex`	4	2	HID(Usage Defined)	
`wLength`	6	2	Length of string	

Table 3.7: GetDescriptor(String) Request

Sublanguage ID	**LANGID Name**	**Description**
00	*Reserved*	*Reserved*
01	Usage Data Descriptor	Allows a Usage to define a data structure that is specific to the Usage
02 - 3B	*Reserved*	*Reserved*
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**
`bLength`	0	1	Number	Size of this descriptor in bytes
`bDescriptorType`	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 ($n <= 253$)	Vendor Defined	Vendor defined fields

Table 3.10: Vendor Defined Descriptor

4 Generic Desktop Page (0x01)

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Pointer**	CP	4.1
02	**Mouse**	CA	4.1
03-03	*Reserved*		
04	**Joystick**	CA	4.1
05	**Gamepad**	CA	4.1
06	**Keyboard**	CA	4.1
07	**Keypad**	CA	4.1
08	**Multi-axis Controller**	CA	4.1
09	**Tablet PC System Controls**	CA	4.1
0A	**Water Cooling Device** [6]	CA	4.1
0B	**Computer Chassis Device** [6]	CA	4.1
0C	**Wireless Radio Controls** [13]	CA	4.1
0D	**Portable Device Control** [23]	CA	4.1
0E	**System Multi-Axis Controller** [33]	CA	4.1
0F	**Spatial Controller** [39]	CA	4.1
10	**Assistive Control** [49]	CA	4.1
11	**Device Dock** [57]	CA	4.15
12	**Dockable Device** [57]	CA	4.15
13	**Call State Management Control** [73]	CA	4.16
14-2F	*Reserved*		
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	**Counted Buffer**	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	*Reserved*		
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	*Reserved*		
80	**System Control**	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	**Thumbstick** [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	*Reserved*		

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	System Microphone Mute [77]	OOC	4.5
AA-AF	*Reserved*		
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	*Reserved*		
C0	**Sensor Zone** [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	**Chassis Enclosure** [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	*Reserved*		
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-DF	*Reserved*		
E0	Call Active LED [73]	OOC	4.16
E1	Call Mute Toggle [73]	OSC	4.16
E2	Call Mute LED [73]	OOC	4.16
E3-FFFF	*Reserved*		

Table 4.1: Generic Desktop Page

4.1 Application Usages

Usage Name	Usage Type	Description
Pointer	CP	A collection of axes that generates a value to direct, indicate, or point user intentions to an application.
Mouse	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.
Joystick	CA	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. 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 **Units** or **Physical Minimum** and **Physical Maximum** values for their axes. Depending on the driver, these items may be ignored if they are declared.
Gamepad	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.
Keyboard	CA	The primary computer input device. A **Keyboard** minimally consists of 103 buttons as defined by the **Boot Keyboard** definition.
Keypad	CA	Any keyboard configuration that does not meet the minimum requirements of the **Boot Keyboard**. **Keypad** often refers to a supplementary calculator-style keyboard.
Multi-axis Controller	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.
Tablet PC System Controls	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.
Water Cooling Device	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.
Computer Chassis Device	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.
Wireless Radio Controls	CA	A collection of buttons or switches that enable all-wireless radio communication to be turned on/off.
Portable Device Control	CA	A collection of controls on the portable devices, for example, volume controls, rotation lock, power, camera controls, home button, etc.

System Multi-Axis Controller	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.
Spatial Controller	CA	A handheld input device that users move freely through space to provide position and orientation input.
Assistive Control	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 (Z).
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	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. 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.
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**
RMV	Resolution Multiplier Value
$LMin$	Logical Minimum
$LMax$	Logical Maximum
$PMin$	Physical Minimum
$PMax$	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 Vx, Vy, Vz, Vbrx, Vbry, Vbrz, and Vno, **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**
Vx	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.
Vy	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.
Vz	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.
Vbrx	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 *forward* axis for an object.
Vbry	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.
Vbrz	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.
Vno	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
System Control	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 *Fn* 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 *Power* button.
System Do Not Disturb	OOC	Toggle system-wide *Do Not Disturb* (DND) mode On/Off.
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

System Microphone Mute	OOC	Toggle system-wide 'microphone mute' state On/Off. (e.g. if system 'microphone mute' state is unmute, toggle it to mute, and vice-versa). Asserting this Usage indicates to turn-off/disable/mute all microphones at system level (and-vice-versa). The system maintains a global 'microphone mute state which affects microphones connected internally and externally. *Note: The device cannot derive the current system 'microphone mute' state from the lack-of or previous assertion of this Usage or any other Usage. (as the system 'microphone mute' state may have been set by a user via system UI, or another device).* *Note: This conceptually 'overrides' the 'Call Mute Toggle' state, as a 'Call' may not be muted, but all system microphones being muted has a similar affect.*

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.

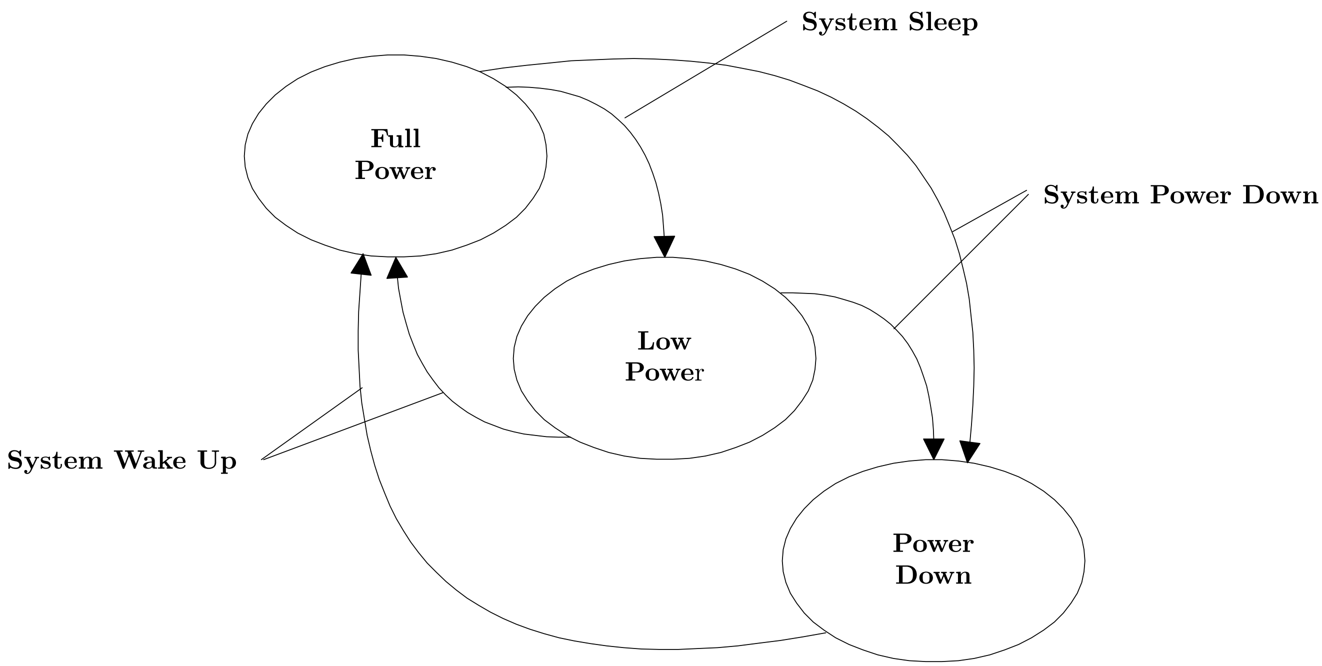


Figure 4.1: System Power States

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 no 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
Counted Buffer	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 **Main** 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 is the changes are only occasional. The Feature Notification usages provides a mechanism for doing this.

Usage Name	**Usage Type**	**Description**
Feature Notification	DV	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. If Report IDs are declared in the device's report descriptor then the **Report Size** 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 **Report Count** to be greater than 1. If Report IDs are not declared in the device's report descriptor then the **Report Size** 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. When a valid Feature Notification is received, the host must issue a `GetReport(Feature)` request to the device with the appropriate report ID.

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: • System Display Internal • System Display External • System Display Both
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
Sensor Zone	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.
Chassis Enclosure	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	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. When disabled, controls that are declared without the `NULL` attribute will keep their last values. Controls that declare the `NULL` attribute will be in a `NULL` state without further state changes. Also, such controls that are not in `NULL` that get disabled will move to `NULL` and input controls should generate a report to that effect. Feature and output reports will change silently.

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.
Thumbstick	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.

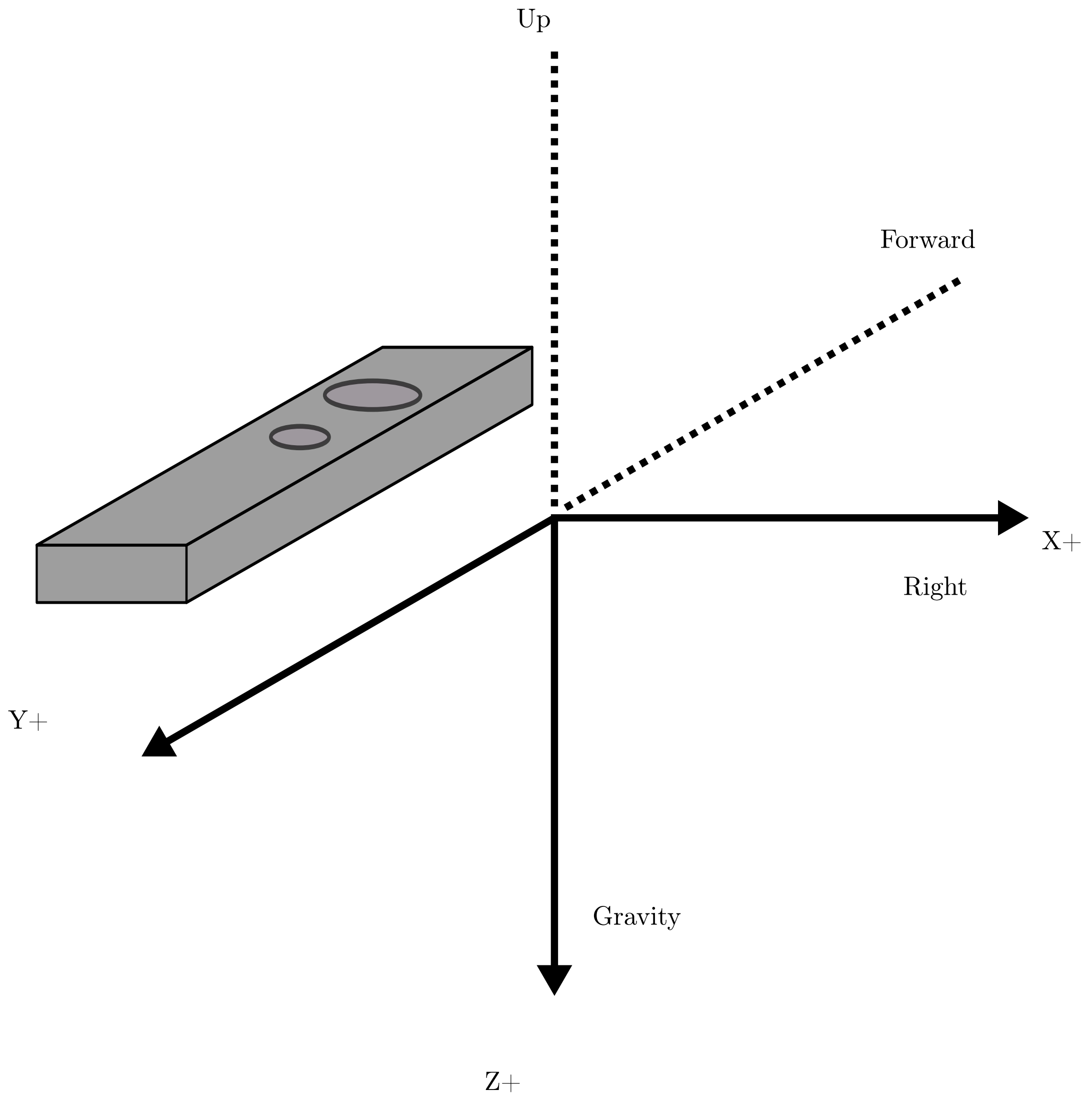


Figure 4.2: Spatial Controller Orientation

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 though 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 **Dockable Device** physically attached to the system.
Dockable Device	CA	A device describing a **Dockable Device** that *can* 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 ***optional*** Usage - if the **Dockable Device** does not have a **Dockable Device Unique ID** or the **Device Dock** is not capable of reading the **Dockable Device Unique ID** from the device, this would not be provided. If provided, the **Dockable Device Unique ID** must be unique for the USB-IF VendorId, specified by **Dockable Device Vendor ID** below. For example, this could contain the unique serial number of the **Dockable Device** or a product identifier if a serial number cannot be provided.
Dockable Device Vendor ID	DV	Specifies the USB-IF VendorId of the **Dockable Device**, used in combination with **Dockable Device Unique ID** to uniquely identify the device. This is an ***optional*** 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 ***optional*** Usage which can be useful in cases where the **Dockable Device** is not connected to the system, or is not capable of reporting a unique serial number, in conjunction with **Dockable Device Primary Usage ID**. For a **Dockable Device** 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 **Dockable Device** (in the case of a complex HID device). This is an ***optional*** Usage, used in conjunction with **Dockable Device Primary Usage Page**. For a **Dockable Device** with multiple HID top-level collections, the value of this Usage is defined by the vendor.

Dockable Device Docking State	DF	A bit that indicates if the **Dockable Device** is currently attached to the system. This is a ***required*** Usage. A report with this bit set would indicate the **Dockable Device** is physically attached to the system. A report with this bit cleared would indicate the **Dockable Device** has been physically detached from the system.
Dockable Device Display Occlusion	CL	A physical collection describing what portion of a display is occluded by the **Device Dock**. This collection is ***optional*** – it would not be reported if the supported **Dockable Device** 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 **Dockable Device** shapes.
Dockable Device Object Type	DV	An enum which specifies the type of object which is being docked. This is an ***optional*** usage. It is possible that there could be multiple Dockable Objects placed relative to the display that also include different objects types such as: • 0: Unspecified. • 1: HID Device. • 2: Display. • 3: NFC Device.

4.16 Call State Management Control

System environments can offer rich integration of voice/video conferencing applications within the Shell and system-wide management of 'calls' by having a single system-wide 'call' state. This state can then be modified via a native Shell experience or through a brokered device ('Call State Management Control'). Such a device could be standalone or even integrated into keyboards as are some system-control devices today (e.g. for power/sleep). 'Call Mute', is NOT intended to be a replacement for existing functionality on existing Audio/Telephony headsets. It is NOT expected, for 'Call State Management Control' devices to be combined/integrated with Telephony Devices or Audio Input devices.

Unlike existing Telephony controls (which reflect the state of a specific audio device, (e.g. headset/speakerphone) associated with the controls) the below are for system consumption, and is up to the system to decide how best reflect the 'call' state across devices affected by a 'call' (e.g. Telephony headset, generic standalone microphone, webcam, non-HIDs, etc...).

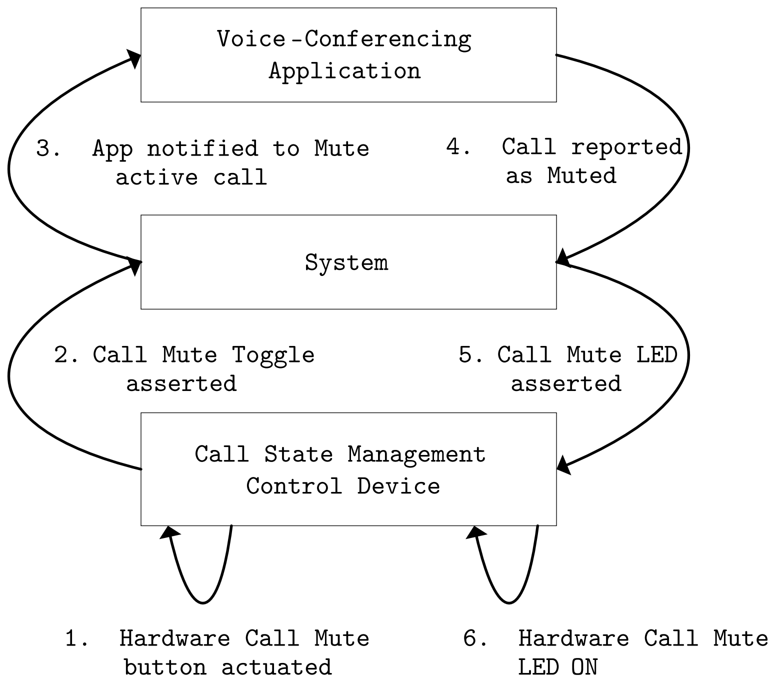
Naturally, if there are multiple devices with these Usages, the system will be responsible for deciding how to broker and maintain state across devices (e.g. similar to a Keyboard's CapsLock LED).

Usage Name	Usage Type	Description
Call State Management Control	CA	System controls for managing the state of the (single) system 'call'.
Call Active LED	OOC	Asserted by System to indicate there is a currently active system 'call'. Level Triggered. *Note: The device must never depend on this value for internal state management other than LED state (i.e. display only). Do NOT tie this state to 'Call Mute Toggle' or any other device state (e.g. audio). Doing so will create issues with system management of the device and system 'call' mute state.*
Call Mute Toggle	OSC	Toggles the system's 'call' mute state, indicating to the system it must change its current 'call' mute state. (e.g. if system 'call' mute state is unmute, toggle it to mute, and vice-versa). Asserting this Usage does not indicate to turn-off/disable/mute system microphones (or-vice-versa). Rather, assertion indicates to the system that audio input should/should-not be rendered on the active 'call'. (e.g. background noise-cancelling algorithms in voice-conferencing applications can always access and process audio input.) *Note: The device cannot derive the current system 'call' mute state from the lack-of or previous assertion of this Usage or any other Usage. (as system 'call' mute state may have been set by a user via system/app UI, or another device).*
Call Mute LED	OOC	Asserted by System to indicate the system's 'call' mute state is muted. Level Triggered. *Note: The device must never depend on this value for internal state management other than LED state (i.e. display only). Do NOT tie this state to 'Call Mute Toggle' or any other device state (e.g. audio). Doing so will create issues with system management of the device and system 'call' mute state.*

4.16.1 Example 1

User mutes an ongoing call (from device)

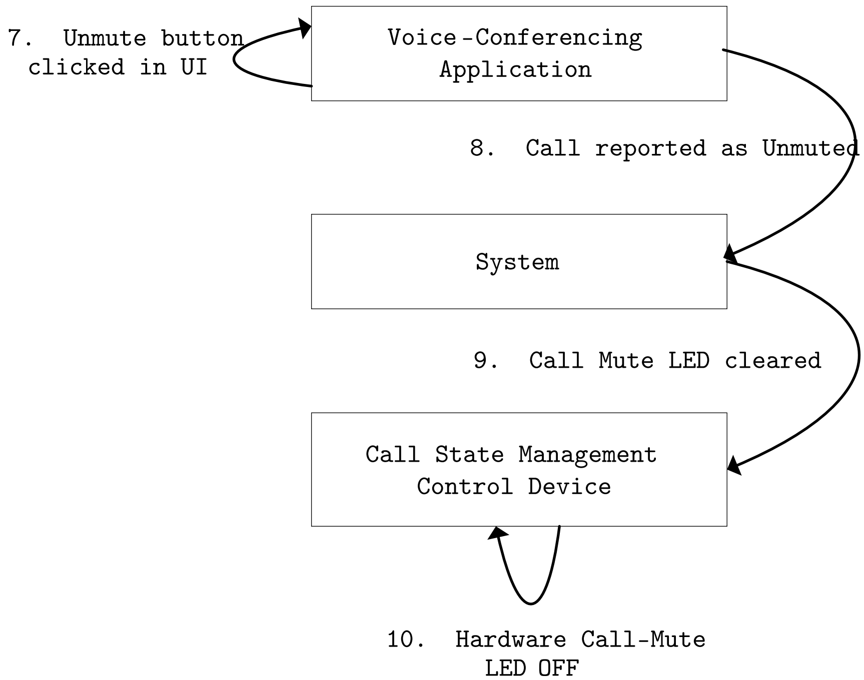
1. User actuates the hardware Call-Mute button to mute their channel.
2. 'Call State Management Control' device asserts the 'Call Mute Toggle' usage.
3. System informs the voice-conferencing application that it must mute the user's channel on the call.
4. Voice-conferencing application applies the channel mute and reports the new mute state to the System.
5. System asserts the 'Call Mute LED' control on the 'Call State Management Control' device.
6. Hardware Call-Mute LED illuminates, indicating to the User that their channel is muted.



4.16.2 Example 2

User unmutes an ongoing 'call' from a voice-conferencing application UI.

1. User clicks on the voice-conferencing application's unmute button to unmute their channel.
2. Voice-conferencing application removes the channel mute and reports the new mute state to the System.
3. System clears the 'Call Mute LED' control on the 'Call State Management Control' device.
4. Hardware Call-Mute LED darkens, indicating to the User that their channel is unmuted.



5 Simulation Controls Page (0x02)

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

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	*Reserved*		

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
Sports Simulation Device	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
Flight Simulation Device	CA	This usage definition allows a device to be generally classified as one that uses the standard controls found on an airplane.
Spaceship Simulation Device	CA	This usage definition allows a device to be generally classified as one that uses standard controls found on a spaceship.
Airplane Simulation Device	CA	This usage definition allows a device to be generally classified as one that uses standard controls found on an airplane.
Helicopter Simulation Device	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.
Cyclic Control	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.
Cyclic Trim	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.
Flight Control Stick	CA	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. Mechanically, a stick presents two degrees of rotational freedom with approximately a +/–45° range. However, these axes are represented as Generic Desktop Page translational axes X (Roll) and Y (Pitch).
Flight Stick	CA	A **Flight Stick** defines a class of device commonly used for flight simulator games. For a device to qualify as a **Flight Stick**, it must support at least two axes (Pitch and Roll), a trigger button, three additional buttons, and a hat switch. A **Flight Stick** is a functional subset of a **Flight Control Stick**.
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.
Flight Yoke	CA	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. 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.

5.3 Automobile Simulation Devices

Usage Name	Usage Type	Description
Automobile Simulation Device	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 *straight ahead* 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
Tank Simulation Device	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.
Track Control	CP	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: 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. 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 **Tank Track Control** is a dimensionless analog entity.
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
Submarine Simulation Device	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.
Sailing Simulation Device	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**
Motorcycle Simulation Device	CA	Allows a device to be generally classified as one that uses the standard controls of a motorcycle.
Bicycle Simulation Device	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
Magic Carpet Simulation Device	CA	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. 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. 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. 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.

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	*Undefined*		
01	**Belt**	CA	6.1
02	**Body Suit**	CA	6.1
03	**Flexor**	CP	6.1
04	**Glove**	CA	6.1
05	**Head Tracker**	CP	6.1
06	**Head Mounted Display**	CA	6.1
07	**Hand Tracker**	CA	6.1
08	**Oculometer**	CA	6.1
09	**Vest**	CA	6.1
0A	**Animatronic Device**	CA	6.1
0B-1F	*Reserved*		
20	Stereo Enable	OOC	6.2
21	Display Enable	OOC	6.2
22-FFFF	*Reserved*		

Table 6.1: VR Controls Page

6.1 VR Control Devices

Usage Name	Usage Type	Description
Belt	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.
Body Suit	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.
Flexor	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.
Glove	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.
Head Tracker	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.
Head Mounted Display	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.
Hand Tracker	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.
Oculometer	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.
Vest	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.
Animatronic Device	CA	An input device for the animation of mechanical or Computer Graphic Image *electronic* 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. 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.

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

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
Baseball Bat	CA	Primary input device for baseball simulation applications. Normally consists of a collection of Stick usages.
Golf Club	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 **Stick Type**. 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 *sweet spot*. 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.
Stick Type	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
Rowing Machine	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.
Treadmill	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`	*Undefined*		
`01`	**3D Game Controller**	CA	8.1
`02`	**Pinball Device**	CA	8.2
`03`	**Gun Device**	CA	8.3
`04-1F`	*Reserved*		
`20`	**Point of View**	CP	8.1
`21`	Turn Right/Left	DV	8.1
`22`	Pitch Forward/Backward	DV	8.1
`23`	Roll Right/Left	DV	8.1
`24`	Move Right/Left	DV	8.1
`25`	Move Forward/Backward	DV	8.1
`26`	Move Up/Down	DV	8.1
`27`	Lean Right/Left	DV	8.1
`28`	Lean Forward/Backward	DV	8.1
`29`	Height of POV	DV	8.1
`2A`	Flipper	MC	8.2
`2B`	Secondary Flipper	MC	8.2
`2C`	Bump	MC	8.2
`2D`	New Game	OSC	8.2
`2E`	Shoot Ball	OSC	8.2
`2F`	Player	OSC	8.2
`30`	Gun Bolt	OOC	8.3
`31`	Gun Clip	OOC	8.3
`32`	**Gun Selector**	NAry	8.3
`33`	Gun Single Shot	Sel	8.3
`34`	Gun Burst	Sel	8.3
`35`	Gun Automatic	Sel	8.3
`36`	Gun Safety	OOC	8.3
`37`	**Gamepad Fire/Jump**	CL	8.4.1
`38-38`	*Reserved*		
`39`	**Gamepad Trigger**	CL	8.4.1
`3A`	Form-fitting Gamepad	SF	8.4.1
`3B-FFFF`	*Reserved*		

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
3D Game Controller	CA	A collection of 3D movement usages.
Point of View	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. *(Note: These directions may appear counter-intuitive but they are consistent with the HID orientation conventions.)* 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. *(Note: These directions may appear counter-intuitive but they are consistent with the HID orientation conventions.)* 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. *(Note: These directions may appear counter-intuitive but they are consistent with the HID orientation conventions.)* 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. *(Note: These directions may appear counter-intuitive but they are consistent with the HID orientation conventions.)*

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
Pinball Device	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
Gun Device	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.
Gun Selector	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
Gamepad Fire/Jump	CL	A collection of gamepad buttons controlled by the user's thumb.
Gamepad Trigger	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). • Value of 1 means that the Gamepad is form-fitting. • Value of 0 means that the Gamepad is not form-fitting.

9 Generic Device Controls Page (0x06)

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Background/Nonuser Controls** [4] [65]	CA	9.1
02-1F	*Reserved*		
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	**Software Version** [32]	CL	9.3
2B	**Protocol Version** [32]	CL	9.3
2C	**Hardware Version** [32]	CL	9.3
2D	Major [32]	SV	9.3
2E	Minor [32]	SV	9.3
2F	Revision [32]	SV	9.3
30	**Handedness** [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	*Reserved*		
40	**Grip Pose Offset** [40]	CP	9.4
41	**Pointer Pose Offset** [40]	CP	9.4
42-FFFF	*Reserved*		

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
Background/Nonuser Controls	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 **Logical Minimum** and **Logical Maximum** 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
Software Version	CL	This is a collection used for software version information. Typical use would be to indicate a software or firmware version in `major.minor.revision` format. *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.*
Protocol Version	CL	This is a collection used for protocol version information.
Hardware Version	CL	This is a collection used for hardware version information.
Major	SV	Major version number.
Minor	SV	Minor version nimber.
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
Handedness	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.
Grip Pose Offset	CP	The device's fixed transform in position and rotation of its grip pose[2] relative to its tracking pose [1].
Pointer Pose Offset	CP	The device's fixed transform in position and rotation of its pointer pose[3] relative to its tracking pose[1].

[1]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.

[2]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)

[3]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	*Reserved*						
01	Keyboard ErrorRollOver[1]	Sel	*N/A*	✓	✓	✓	4/101/104
02	Keyboard POSTFail[1]	Sel	*N/A*	✓	✓	✓	4/101/104
03	Keyboard ErrorUndefined[1]	Sel	*N/A*	✓	✓	✓	4/101/104
04	Keyboard a and A[2]	Sel	31	✓	✓	✓	4/101/104
05	Keyboard b and B	Sel	50	✓	✓	✓	4/101/104
06	Keyboard c and C[2]	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[2]	Sel	52	✓	✓	✓	4/101/104
11	Keyboard n and N	Sel	51	✓	✓	✓	4/101/104
12	Keyboard o and O[2]	Sel	25	✓	✓	✓	4/101/104
13	Keyboard p and P[2]	Sel	26	✓	✓	✓	4/101/104
14	Keyboard q and Q[2]	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[2]	Sel	18	✓	✓	✓	4/101/104
1B	Keyboard x and X[2]	Sel	47	✓	✓	✓	4/101/104
1C	Keyboard y and Y[2]	Sel	22	✓	✓	✓	4/101/104
1D	Keyboard z and Z[2]	Sel	46	✓	✓	✓	4/101/104
1E	Keyboard 1 and ![2]	Sel	2	✓	✓	✓	4/101/104
1F	Keyboard 2 and @[2]	Sel	3	✓	✓	✓	4/101/104
20	Keyboard 3 and #[2]	Sel	4	✓	✓	✓	4/101/104
21	Keyboard 4 and $[2]	Sel	5	✓	✓	✓	4/101/104
22	Keyboard 5 and %[2]	Sel	6	✓	✓	✓	4/101/104
23	Keyboard 6 and ^[2]	Sel	7	✓	✓	✓	4/101/104
24	Keyboard 7 and &[2]	Sel	8	✓	✓	✓	4/101/104
25	Keyboard 8 and *[2]	Sel	9	✓	✓	✓	4/101/104
26	Keyboard 9 and ([2]	Sel	10	✓	✓	✓	4/101/104
27	Keyboard 0 and)[2]	Sel	11	✓	✓	✓	4/101/104
28	Keyboard Return (ENTER)[3]	Sel	43	✓	✓	✓	4/101/104
29	Keyboard ESCAPE	Sel	110	✓	✓	✓	4/101/104
2A	Keyboard DELETE (Backspace)[4]	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)[2]	Sel	12	✓	✓	✓	4/101/104
2E	Keyboard = and +[2]	Sel	13	✓	✓	✓	4/101/104
2F	Keyboard [and {[2]	Sel	27	✓	✓	✓	4/101/104
30	Keyboard] and }[2]	Sel	28	✓	✓	✓	4/101/104
31	Keyboard \and |	Sel	29	✓	✓	✓	4/101/104
32	Keyboard Non-US # and ~[5]	Sel	42	✓	✓	✓	4/101/104
33	Keyboard ; and :[2]	Sel	40	✓	✓	✓	4/101/104
34	Keyboard ‘ and “[2]	Sel	41	✓	✓	✓	4/101/104
35	Keyboard Grave Accent and Tilde[2]	Sel	1	✓	✓	✓	4/101/104
36	Keyboard , and <[2]	Sel	53	✓	✓	✓	4/101/104
37	Keyboard . and >[2]	Sel	54	✓	✓	✓	4/101/104
38	Keyboard / and ?[2]	Sel	55	✓	✓	✓	4/101/104
39	Keyboard Caps Lock[6]	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[7]	Sel	124	✓	✓	✓	4/101/104
47	Keyboard Scroll Lock[6]	Sel	125	✓	✓	✓	4/101/104
48	Keyboard Pause[7]	Sel	126	✓	✓	✓	4/101/104
49	Keyboard Insert[7]	Sel	75	✓	✓	✓	4/101/104
4A	Keyboard Home[7]	Sel	80	✓	✓	✓	4/101/104
4B	Keyboard PageUp[7]	Sel	85	✓	✓	✓	4/101/104
4C	Keyboard Delete Forward[7,8]	Sel	76	✓	✓	✓	4/101/104
4D	Keyboard End[7]	Sel	81	✓	✓	✓	4/101/104
4E	Keyboard PageDown[7]	Sel	86	✓	✓	✓	4/101/104
4F	Keyboard RightArrow[7]	Sel	89	✓	✓	✓	4/101/104
50	Keyboard LeftArrow[7]	Sel	79	✓	✓	✓	4/101/104
51	Keyboard DownArrow[7]	Sel	84	✓	✓	✓	4/101/104
52	Keyboard UpArrow[7]	Sel	83	✓	✓	✓	4/101/104
53	Keypad Num Lock and Clear[6]	Sel	90	✓	✓	✓	4/101/104
54	Keypad /[7]	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[3]	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 |[9,10]	Sel	45	✓	✓	✓	4/101/104
65	Keyboard Application[11]	Sel	129	✓		✓	104
66	Keyboard Power[1]	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[12]	Sel				✓	
83	Keyboard Locking Num Lock[12]	Sel				✓	
84	Keyboard Locking Scroll Lock[12]	Sel				✓	
85	Keypad Comma[13]	Sel	107				
86	Keypad Equal Sign[14]	Sel				✓	
87	Keyboard International1[15,16]	Sel	56				
88	Keyboard International2[17]	Sel					
89	Keyboard International3[18]	Sel					
8A	Keyboard International4[19]	Sel					

Usage ID	Usage Name	Usage Type	AT-101	PC-AT	Mac	Unix	Boot
8B	Keyboard International5[20]	Sel					
8C	Keyboard International6[21]	Sel					
8D	Keyboard International7[22]	Sel					
8E	Keyboard International8[23]	Sel					
8F	Keyboard International9[23]	Sel					
90	Keyboard LANG1[24]	Sel					
91	Keyboard LANG2[25]	Sel					
92	Keyboard LANG3[26]	Sel					
93	Keyboard LANG4[27]	Sel					
94	Keyboard LANG5[28]	Sel					
95	Keyboard LANG6[29]	Sel					
96	Keyboard LANG7[29]	Sel					
97	Keyboard LANG8[29]	Sel					
98	Keyboard LANG9[29]	Sel					
99	Keyboard Alternate Erase[30]	Sel					
9A	Keyboard SysReq/Attention[7]	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	*Reserved*						
B0	Keypad 00	Sel					
B1	Keypad 000	Sel					
B2	Thousands Separator[31]	Sel					
B3	Decimal Separator[31]	Sel					
B4	Currency Unit[32]	Sel					
B5	Currency Sub-unit[32]	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	*Reserved*						
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[11,33]	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[11,34]	DV	128	✓	✓	✓	104
`E8-FFFF`	*Reserved*						

[1]Reserved for typical keyboard status or keyboard errors. Sent as a member of the keyboard array. Not a physical key.

[2]Typically remapped for other languages in the host system.

[3]Keyboard Enter and Keypad Enter generate different Usage codes.

[4]Backs up the cursor one position, deleting a character as it goes.

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

[6]Implemented as a non-locking key; sent as member of an array.

[7]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.

[8]Deletes one character without changing position.

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

[10]Typically near the Left-Shift key in AT-102 implementations.

[11]Windows key for Windows 95, and *Compose*.

[12]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.

[13]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.

[14]Used on AS/400 keyboards.

[15]See additional footnotes below

[16]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.

[17]See additional footnotes below

[18]See additional footnotes below

[19]See additional footnotes below

[20]See additional footnotes below

[21]See additional footnotes below

[22]Toggle Double-Byte/Single-Byte mode.

[23]Undefined, available for other Front End Language Processors.

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

[25]Hanja conversion key. This usage is used as an input method editor control key on a Korean language keyboard.

[26]Defines the Katakana key for Japanese USB word-processing keyboards.

[27]Defines the Hiragana key for Japanese USB word-processing keyboards.

[28]Defines the Zenkaku/Hankaku key for Japanese USB word-processing keyboards.

[29]Reserved for language-specific functions, such as Front End Processors and Input Method Editors.

[30]Example, Erase-Eaze™ key.

[31]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.

[32]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 ¢.

[33]Windowing environment key, examples are Microsoft Left Win key, Mac Left Apple key, Sun Left Meta key

[34]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	ー | ＼ ろ	ー ろ
17	No Function	カタカナ ひら がな	かな
18	No Function	| 「 ¥ ー	| ¥ ー
19	No Function	前候補 変換	XFER
20	No Function	無変換	NFER
21	No Function	No Function	, (カンマ)

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

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

52	RGB LED [6]	CL	11.7
53	Red LED Channel [6]	DV	11.7
54	Blue LED Channel [6]	DV	11.7
55	Green LED Channel [6]	DV	11.7
56	LED Intensity [6]	DV	11.7
57	System Microphone Mute [77]	OOC	11.9
58-5F	*Reserved*		
60	**Player Indicator** [29]	NAry	11.8
61	Player 1 [29]	Sel	11.8
62	Player 2 [29]	Sel	11.8
63	Player 3 [29]	Sel	11.8
64	Player 4 [29]	Sel	11.8
65	Player 5 [29]	Sel	11.8
66	Player 6 [29]	Sel	11.8
67	Player 7 [29]	Sel	11.8
68	Player 8 [29]	Sel	11.8
69-FFFF	*Reserved*		

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.
Headset	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.
Usage Selected Indicator	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. **Usage Selected Indicator** 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).
Usage In Use Indicator	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. **Usage In Use Indicator** 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).
Usage Multi Mode Indicator[1]	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.
Usage Indicator Color[1]	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.

Indicator Blue	Sel	Indicator color set to Blue.
Indicator Orange	Sel	Indicator color set to Orange.
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.
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).

[1] 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**
RGB LED	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 intsenity 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
Player Indicator	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.

11.9 System Control Indicators

Usage Name	**Usage Type**	**Description**
System Microphone Mute	OOC	Asserted by System to indicate the system ‘microphone mute’ state is muted.

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

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	*Reserved*		
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	*Reserved*		
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	*Reserved*		

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	**Ring Type** [5]	NAry	14.9
F5	Re-dialable Phone Number [5]	OOC	14.9
F6-F7	*Reserved*		
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	*Reserved*		
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	*Reserved*		
110	Incoming Call History Count [5]	DV	14.10
111	Outgoing Call History Count [5]	DV	14.10
112	**Incoming Call History** [5]	CL	14.10
113	**Outgoing Call History** [5]	CL	14.10
114	Phone Locale [5]	DV	14.8
115-13F	*Reserved*		
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	*Reserved*		
14A	Call Duration [5]	DV	14.10
14B	**Dual Mode Phone**	CA	14.8
14C-FFFF	*Reserved*		

Table 14.1: Telephony Device Page

14.1 Telephony Devices

Usage Name	Usage Type	Description
Phone	CA	An application-level collection that identifies a device containing telephone controls.
Answering Machine	CA	An application level collection that identifies a device containing primarily voice mail or answering machine controls.
Dual Mode Phone	CA	Top level collection of reports for a telephony device which can handle both standard PSTN phone and host based voice calls.
Message Controls	CL	Usages related to voice mail controls.
Handset	CL	Usages related to the handle-shaped part of a telephone, containing the audio receiver and transmitter.
Headset	CL/CA	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
Telephony Key Pad	NAry	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. 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).
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
Programmable Button	NAry	Programmable telephone buttons. This collection contains usages from the Button usage page. Programmable Buttons 1 through n are represented by Button page usages 1 through n, respectively.

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.
Line	OSC/NAry	Line selection. If 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

Usage Name	**Usage Type**	**Description**
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. [1]
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	OOC	Turn all tones off, negating all control values.
Ringer	OOC	This usage generates the incoming telephone call tone heard by the user while the phone is *On Hook*. 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.

[1] 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

Usage Name	Usage Type	Description
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 Section 22.1.4 Character Transfers .
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
Ring Type	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 Section 15.17 Contact List Controls .
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 Section 15.17 Contact List Controls .
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	*Undefined*		
01	**Consumer Control**	CA	15.1
02	**Numeric Key Pad**	NAry	15.2
03	**Programmable Buttons**	NAry	15.14
04	**Microphone**	CA	15.1
05	**Headphone**	CA	15.1
06	**Graphic Equalizer**	CA	15.1
07-1F	*Reserved*		
20	+10	OSC	15.2
21	+100	OSC	15.2
22	AM/PM	OSC	15.2
23-2F	*Reserved*		
30	Power	OOC	15.3
31	Reset	OSC	15.3
32	Sleep	OSC	15.3
33	Sleep After	OSC	15.3
34	Sleep Mode	RTC	15.3
35	Illumination	OOC	15.3
36	**Function Buttons**	NAry	15.3
37-3F	*Reserved*		
40	Menu	OOC	15.4
41	Menu Pick	OSC	15.4
42	Menu Up	OSC	15.4
43	Menu Down	OSC	15.4
44	Menu Left	OSC	15.4
45	Menu Right	OSC	15.4
46	Menu Escape	OSC	15.4
47	Menu Value Increase	OSC	15.4
48	Menu Value Decrease	OSC	15.4
49-5F	*Reserved*		
60	Data On Screen	OOC	15.5
61	Closed Caption	OOC	15.5
62	Closed Caption Select	OSC	15.5
63	VCR/TV	OOC	15.5
64	Broadcast Mode	OSC	15.5
65	Snapshot	OSC	15.5
66	Still	OSC	15.5
67	Picture-in-Picture Toggle [8]	OSC	15.5

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	**Selection**	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	**Media Selection**	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	*Reserved*		
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	*Reserved*		
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	**Select Disc**	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	Start or Stop Voice Dictation Session [66]	OOC	15.3
D9	Invoke/Dismiss Emoji Picker [68]	OOC	15.3
DA-DF	*Reserved*		
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	*Reserved*		
F0	Speed Select	OSC	15.10
F1	**Playback Speed**	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	*Reserved*		
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	15.11
106	Security Enable	OOC	15.11
107	Fire Alarm	OSC	15.11
108	Police Alarm	OSC	15.11
109	Proximity	LC	15.11
10A	Motion	OSC	15.11
10B	Duress Alarm	OSC	15.11
10C	Holdup Alarm	OSC	15.11
10D	Medical Alarm	OSC	15.11
10E-14F	*Reserved*		
150	Balance Right	RTC	15.9
151	Balance Left	RTC	15.9
152	Bass Increment	RTC	15.9
153	Bass Decrement	RTC	15.9
154	Treble Increment	RTC	15.9
155	Treble Decrement	RTC	15.9
156-15F	*Reserved*		
160	**Speaker System**	CL	15.12
161	**Channel Left**	CL	15.12
162	**Channel Right**	CL	15.12
163	**Channel Center**	CL	15.12
164	**Channel Front**	CL	15.12
165	**Channel Center Front**	CL	15.12
166	**Channel Side**	CL	15.12
167	**Channel Surround**	CL	15.12
168	**Channel Low Frequency Enhancement**	CL	15.12
169	**Channel Top**	CL	15.12
16A	**Channel Unknown**	CL	15.12
16B-16F	*Reserved*		
170	Sub-channel	LC	15.13
171	Sub-channel Increment	OSC	15.13
172	Sub-channel Decrement	OSC	15.13
173	Alternate Audio Increment	OSC	15.13
174	Alternate Audio Decrement	OSC	15.13
175-17F	*Reserved*		
180	**Application Launch Buttons**	NAry	15.15
181	AL Launch Button Configuration Tool	Sel	15.15
182	AL Programmable Button Configuration	Sel	15.15
183	AL Consumer Control Configuration	Sel	15.15
184	AL Word Processor	Sel	15.15
185	AL Text Editor	Sel	15.15
186	AL Spreadsheet	Sel	15.15

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

1B0	AL Encryption	Sel	15.15
1B1	AL Screen Saver	Sel	15.15
1B2	AL Alarms	Sel	15.15
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	*Reserved*		
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	*Reserved*		
200	**Generic GUI Application Controls**	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	*Reserved*		
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	15.16
221	AC Search	Sel	15.16
222	AC Go To	Sel	15.16
223	AC Home	Sel	15.16
224	AC Back	Sel	15.16
225	AC Forward	Sel	15.16
226	AC Stop	Sel	15.16
227	AC Refresh	Sel	15.16
228	AC Previous Link	Sel	15.16
229	AC Next Link	Sel	15.16
22A	AC Bookmarks	Sel	15.16
22B	AC History	Sel	15.16
22C	AC Subscriptions	Sel	15.16
22D	AC Zoom In	Sel	15.16
22E	AC Zoom Out	Sel	15.16
22F	AC Zoom	LC	15.16
230	AC Full Screen View	Sel	15.16
231	AC Normal View	Sel	15.16
232	AC View Toggle	Sel	15.16
233	AC Scroll Up	Sel	15.16
234	AC Scroll Down	Sel	15.16
235	AC Scroll	LC	15.16
236	AC Pan Left	Sel	15.16
237	AC Pan Right	Sel	15.16
238	AC Pan	LC	15.16
239	AC New Window	Sel	15.16
23A	AC Tile Horizontally	Sel	15.16
23B	AC Tile Vertically	Sel	15.16
23C	AC Format	Sel	15.16
23D	AC Edit	Sel	15.16
23E	AC Bold	Sel	15.16
23F	AC Italics	Sel	15.16
240	AC Underline	Sel	15.16
241	AC Strikethrough	Sel	15.16
242	AC Subscript	Sel	15.16
243	AC Superscript	Sel	15.16
244	AC All Caps	Sel	15.16
245	AC Rotate	Sel	15.16
246	AC Resize	Sel	15.16
247	AC Flip Horizontal	Sel	15.16
248	AC Flip Vertical	Sel	15.16

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

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

2A0	AC Soft Key Left [5]	Sel	15.16
2A1	AC Soft Key Right [5]	Sel	15.16
2A2	AC Desktop Show All Applications [64]	Sel	15.16
2A3-2AF	*Reserved*		
2B0	AC Idle Keep Alive [5]	Sel	15.16
2B1-2BF	*Reserved*		
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	*Reserved*		
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	*Reserved*		
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	15.17
511	Contact Email Main [5]	DV	15.17
512	Contact Speed Dial Number [5]	DV	15.17
513	Contact Status Flag [5]	DV	15.17
514	Contact Misc. [5]	DV	15.17
515-FFFF	*Reserved*		

Table 15.1: Consumer Page

15.1 Generic Consumer Control Device

Usage Name	Usage Type	Description
Consumer Control	CA	General consumer control device.
Microphone	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.
Headphone	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.
Graphic Equalizer	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
Numeric Key Pad	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 Section 4.5 System Controls .
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.
Function Buttons	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 Section 12 Button Page (`0x09`) 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.
Start/Stop Voice Dictation Session	OOC	Starts or stops a voice dictation session. If a session is not in progress, activation will start a new dictation session. If a session is in progress, activation will stop the session.
Invoke/Dismiss Emoji Picker	OOC	Invokes or dismisses the emoji picker widget. If the widget is not active, it will be invoked. If the widget is active, it will be dismissed.

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
Selection	NAry	A collection usage for a number of discrete selections. On a consumer device, these are commonly used for *favorite* 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 **Selection** 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 **Selection** 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	C.hannel 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 [1]	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.
Media Selection	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.

[1] 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.
Select Disc	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 **Select Disc** named array.
Enter Disc	MC	This button works in conjunction with the **Numeric Key Pad** 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 *counter memory* 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.
Playback Speed	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 *SP* recording speed.
Long Play	Sel	Selects the VCR's *LP* recording speed.
Extended Play	Sel	Selects the VCR's *EP* 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.

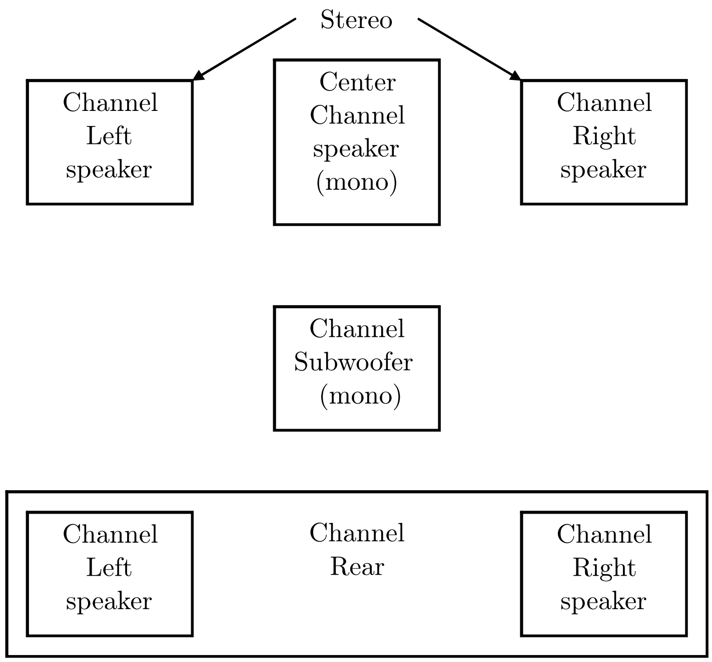


Figure 15.1: Audio Channels

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 Right), 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
Speaker System	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. *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.*
Channel Left	CL	A collection of controls associated with the Left channel.
Channel Right	CL	A collection of controls associated with the Right channel.
Channel Center	CL	A collection of controls associated with the Center channel.
Channel Front	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.
Channel Center Front	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).
Channel Side	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[2]
Channel Surround	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.
Channel Low Frequency Enhancement	CL	A collection of controls associated with the Low Frequency Enhancement or Subwoofer channel. The Audio class notation for this channel is LFE.
Channel Top	CL	A collection of controls associated with the Top or overhead channel. The Audio class notation for this channel is T.
Channel Unknown	CL	A collection of controls associated with an unknown channel position.

[2]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
Programmable Buttons	NAry	The user defines the function of these buttons to control software applications or GUI objects. The Programmable Buttons named array contains Section 12 Button Page (0x09) 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
Application Launch Buttons	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 sepcific 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/Screensaver	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
Generic GUI Application Controls	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	ect 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 evely along a horizontal axis.
AC Distribute Vertically	Sel	Space objects evely 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 devices 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 22 Auxiliary Display Page (`0x14`) and ordering is implied the same was as display data as defined in Section 22.1.4 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**
Extended Keyboard Attributes Collection	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	• 0: Unknown Form Factor. • 1: Full-Size keyboard. • 2: Compact keyboard. Such keyboards are less than 13" wide.
Keyboard Key Type	SV	• 0: Unknown Key Type. • 1: Full-travel keys. • 2: Low-travel keys such as those on laptop keyboards. • 3: Zero-travel or virtual keys.
Keyboard Physical Layout	SV	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. • 0: Unknown Layout. • 1: 101 (e.g. US) • 2: 103 (Korea) • 3: 102 (e.g. German) • 4: 104 (e.g. ABNT Brazil) • 5: 106 (DOS/V Japan) • 6: Vendor-specific - If specified, 'Vendor-Specific Keyboard Physical Layout' must also be specified.
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	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[3] or its successor. Operating systems may use this information to help select a layout that maps keyboard usages to textual glyphs. 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.
Implemented Keyboard Input Assist Controls	SV	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. • All 0: No Keyboard Input Assist controls are implemented. • Bit 0: Previous Suggestion • Bit 1: Next Suggestion • Bit 2: Previous Suggestion Group • Bit 3: Next Suggestion Group • Bit 4: Accept Suggestion • Bit 5: Cancel Suggestion *All other bits reserved.*

[3] 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.

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Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Digitizer**	CA	16.1
02	**Pen**	CA	16.1
03	**Light Pen**	CA	16.1
04	**Touch Screen**	CA	16.1
05	**Touch Pad**	CA	16.1
06	**Whiteboard**	CA	16.1
07	**Coordinate Measuring Machine**	CA	16.1
08	**3D Digitizer**	CA	16.1
09	**Stereo Plotter**	CA	16.1
0A	**Articulated Arm**	CA	16.1
0B	**Armature**	CA	16.1
0C	**Multiple Point Digitizer**	CA	16.1
0D	**Free Space Wand**	CA	16.1
0E	**Device Configuration** [7]	CA	16.7
0F	**Capacitive Heat Map Digitizer** [54]	CA	16.9
10-1F	*Reserved*		
20	**Stylus** [55]	CA/CL	16.2
21	**Puck**	CL	16.2
22	**Finger**	CL	16.2
23	**Device settings** [7]	CL	16.7
24	**Character Gesture** [45]	CL	16.8
25-2F	*Reserved*		
30	Tip Pressure	DV	16.3.1
31	Barrel Pressure	DV	16.3.1
32	In Range	MC	16.3.1
33	Touch	MC	16.3.1
34	Untouch	OSC	16.3.1
35	Tap	OSC	16.3.1
36	Quality	DV	16.3.1
37	Data Valid	MC	16.3.1
38	Transducer Index	DV	16.3.1
39	**Tablet Function Keys**	CL	16.3.1
3A	**Program Change Keys**	CL	16.3.1
3B	Battery Strength	DV	16.3.1
3C	Invert	MC	16.3.1
3D	X Tilt	DV	16.3.2
3E	Y Tilt	DV	16.3.2
3F	Azimuth	DV	16.3.3
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	*Reserved*		
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	**Gesture Character Encoding** [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	Transducer Serial Number Part 2 [70]	SV	16.3.1
6F	No Preferred Color [71]	DF	16.3.1
70	**Preferred Line Style** [31]	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	*Reserved*		
80	**Digitizer Diagnostic** [31]	CL	16.7
81	**Digitizer Error** [31]	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	*Reserved*		
90	**Transducer Software Info** [36]	CL	16.3.1
91	Transducer Vendor Id [36]	SV	16.3.1
92	Transducer Product Id [36]	SV	16.3.1
93	**Device Supported Protocols** [36]	NAry/CL	16.3.1
94	**Transducer Supported Protocols** [36]	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	*Reserved*		
A0	**Supported Report Rates** [36]	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]	CL	16.3.1
A6	Transducer Index Selector [75]	DV	16.3.1
A7-AF	*Reserved*		
B0	Button Press Threshold [78]	DV	16.5
B1-FFFF	*Reserved*		

Table 16.1: Digitizer Page

16.1 Digitizer Devices

Usage Name	Usage Type	Description
Digitizer	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.
Pen	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.
Light Pen	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.
Touch Screen	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.
Touch Pad	CA	A digitizer that is not integrated with a display, but allows the use of a finger for pointing.
White Board	CA	A digitizer that is mounted vertically and can optionally be synchronized with a projected video display.
Coordinate Measuring Machine	CA	A specialized digitizing instrument that is used to make spatial measurements of maps or photographic images. It is not suitable for screen pointing.
3D Digitizer	CA	General usage for a digitizer that measures position(s) in three dimensional space.
Stereo Plotter	CA	A 3D digitizer that relies on the operator's binocular vision to determine the position of points on a stereoscopically rendered image.
Articulated Arm	CA	A 3D digitizer that uses a series of instrumented mechanical linkages to determine the position of its tip in space.
Armature	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.
Multiple Point Digitizer	CA	A 3D digitizer that detects the position of multiple points in space, typically through some non-mechanical means such as electromagnetic sensors.
Free Space Wand	CA	A 3D digitizer that detects the position of a point at the end of a handheld wand.

16.2 Digitizer Transducer Collections

Usage Name	Usage Type	Description
Stylus	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 **Stylus** collection is a physical collection containing all the controls physically located on the stylus. In the **Stylus** collection a **Pointer** physical collection will contain the axes reported by the stylus.
Puck	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 **Puck** collection is a logical collection containing all the controls located on the puck. In the **Puck** collection a **Pointer** physical collection will contain the axes reported by the puck.
Finger	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 **Finger** collection a **Pointer** 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 noisefree 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.
Tablet Function Keys	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.
Program Change Keys	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.
Transducer Serial Number Part 2	SV	More/most significant bits of a unique persistent identifier provided by the transducer currently in use. Expected to be used in conjunction with 'Transducer Serial Number', which describes the lesser significant bits. This permits up to a 64bit (unsigned) serial number, spread across two items. *Note: It is valid to have any number of bits, up to 32 (e.g. 8) for either 'Transducer Serial Number Part 2' and/or 'Transducer Serial Number', where the former describes the upper-bits and the latter describes the lower bits. (If combined these bits are <=32, then it is recommended to only use 'Transducer Serial Number').*

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 [1] [2] with the elimination of the grey/gray duplicates. The color name to index mapping is presented in Appendix A Indices for 8bit Preferred Colors . A value of 0xFF indicates no preferred color. A 24-bit value specifies three 8 bits values for RGB color in that order. The 24-bit value cannot represent the absence of a preferred color; instead use additional 'No Preferred Color'. *Note: 8- and 24-bit Preferred Colors should only both be reported when backwards compatibility is relevant. The device must maintain consistency between the 8-bit value and the 24-bit value combined with the 'No Preferred Color flag'. Hosts are expected to assume consistency and use either the 8-bit value or the combined 24-bit value and the No 'Preferred Color flag'.*
No Preferred Color	DF	Describes whether the transducer has a preferred color. This may be used in conjunction with a 24-bit 'Preferred Color', and is intended to take priority; if set, there is not a preferred color, regardless of the value of 24-bit 'Preferred 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. This relates to 8-bit and 24-bit 'Preferred Color' values, as well as the 'No Preferred Color' flag.
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.
Preferred Line Style	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.

[1] http://www.w3.org/TR/SVG/types.html
[2] http://www.w3.org/TR/css3-color/

Transducer Software Info	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.
Device Supported Protocols	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.
Transducer Supported Protocols	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.
Supported Report Rates	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).
Transducer Switches	CL	Used as a container for switches on a transducer.
Transducer Index Selector	DV	Indicates the selected transducer index for subsequent GetFeature requests. The transducer index reported in subsequent GetFeature reports should be validated to ensure it matches the requested transducer index selector from the most recent SetFeature operation.

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 *pointing* 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.
Button Press Threshold	DV	The required pressure for a user to apply to a touchpad to report a 'button press'. System-configurable to suit user-preference. *Default units are grams.* *Note: This does not affect any physical buttons in close proximity to the touchpad (e.g. mouse left/right buttons).*

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
Device Configuration	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	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. 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.
Device Settings	CL	The logical collection containing the device configuration usages (Device identifier and device mode).
Digitizer Diagnostic	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.
Digitizer Status	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. Additionaly, 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
Character Gesture	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.
Gesture Character Encoding	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 (gounding 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 Digitizer	CA	A digitizer that collects raw capacitive data in a heat map format and reports to the host device for additional processing.
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 neccessary 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 digitzer. 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 specifies 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	*Undefined*		
01	**Simple Haptic Controller**	CA/CL	17.1
02-0F	*Reserved*		
10	**Waveform List**	NAry	17.1
11	**Duration List**	NAry	17.1
12-1F	*Reserved*		
20	Auto Trigger	DV	17.1
21	Manual Trigger	DV	17.1
22	Auto Trigger Associated Control	SV	17.1
23	Intensity	DV	17.1
24	Repeat Count	DV	17.1
25	Retrigger Period	DV	17.1
26	Waveform Vendor Page	SV	17.1
27	Waveform Vendor ID	SV	17.1
28	Waveform Cutoff Time	SV	17.1
29-1000	*Reserved*		
1001	Waveform None	SV	17.1
1002	Waveform Stop	SV	17.1
1003	Waveform Click	SV	17.1
1004	Waveform Buzz Continuous	SV	17.1
1005	Waveform Rumble Continuous	SV	17.1
1006	Waveform Press	SV	17.1
1007	Waveform Release	SV	17.1
1008	Waveform Hover [72]	SV	17.1
1009	Waveform Success [72]	SV	17.1
100A	Waveform Error [72]	SV	17.1
100B	Waveform Ink Continuous [72]	SV	17.1
100C	Waveform Pencil Continuous [72]	SV	17.1
100D	Waveform Marker Continuous [72]	SV	17.1
100E	Waveform Chisel Marker Continuous [72]	SV	17.1

100F	Waveform Brush Continuous [72]	SV	17.1
1010	Waveform Eraser Continuous [72]	SV	17.1
1011	Waveform Sparkle Continuous [72]	SV	17.1
1012-2000	*Reserved*		
2001-2FFF	*Reserved for Vendor Waveforms*		
3000-FFFF	*Reserved*		

Table 17.1: Haptics Page

17.1 Simple Haptic Controller

Usage Name	Usage Type	Description
Simple Haptic Controller	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.
Waveform List	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.
Duration List	NAry	Collection of Ordinals containing the default duration for each haptic waveform. Default units are milliseconds.
Auto Trigger	DV	**Feature**. Ordinal in the Waveform List to trigger autonomously. Default is undefined. If 0, autonomous triggering is disabled.
Manual Trigger	DV	**Output**. 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	**Feature**. 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	**Feature** or **Output**. 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	**Feature** or **Output**. Count of retriggered waveform firings per trigger. Default is zero. `NULL` values are ignored.
Retrigger Period	DV	**Feature** or **Output**. 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 **Feature**. 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 **Feature**. 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	**Feature**. 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	
Waveform Hover	SV	Haptic signal when user hovers over an interactive UI element.
Waveform Success	SV	Strong haptic signal to alert user an action has succeeded.
Waveform Error	SV	Strong haptic signal to alert user an action has failed, or an error has occurred.
Waveform Ink Continuous	SV	Continuous haptic signal to simulate the feel of inking with a physical ballpoint pen.
Waveform Pencil Continuous	SV	Continuous haptic signal to simulate the feel of inking with a physical pencil.
Waveform Marker Continuous	SV	Continuous haptic signal to simulate the feel of inking with a physical marker.
Waveform Chisel Marker Continuous	SV	Continuous haptic signal to simulate the feel of inking with a physical chisel marker / highlighter.
Waveform Brush Continuous	SV	Continuous haptic signal to simulate the feel of inking with a physical brush.
Waveform Eraser Continuous	SV	Continuous haptic signal to simulate the feel of inking with a physical eraser.
Waveform Sparkle Continuous	SV	Continuous haptic signal to simulate the feel of inking with a physical sparkle pen.

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: Instance 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 Instance 1 and `Waveform Stop` in Instance 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 Instance 1 and Instance 2. The implicit Instance 1 and Instance 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 Instance 1 and Instance 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 Instance 1 (Waveform None) has no effect. If the Auto Trigger is set to Instance 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

Instance 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 Instance 0 (Waveform None) to a Manual Trigger or Auto Trigger will have no effect. Any waveform can be immediately canceled by writing Instance 1 (Waveform Stop) to a Manual Trigger. If Instance 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 Physical Input Device Page (0x0F)

A Physical Input Device (PID) generates force-feedback sensations using parameterized, pre-downloaded, waveform-based Effects. A device can support Effects from well-understood waveforms (e.g. **ET Ramp**, **ET Sine**, **ET Spring**), and/or custom waveforms (**ET Custom-Force**). See 18.4.1 Effect Types for all well-known waveforms.

Since Effects (particularly **ET Custom-Force**) may require significant data transferred, all Effects are explicitly configured/downloaded to the device prior to use, and then Started/Stopped by unique (**Effect Parameter Block Index**). This naturally allows reusablity of downloaded Effects, so they do not necessarily have to re-downloaded to be reused. Additionally, this creates a better user-experience, as there is only a delay during device-initialization, and timely control from thereafter.

> *Note: Force-feedback devices use PID Usages to describe their output, and Usages from other Pages to describe their input.*

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Physical Input Device**	CA	18.1
02-1F	*Reserved*		
20	Normal	DV	18.1
21	**Set Effect Report**	CL	18.4
22	Effect Parameter Block Index	DV	18.4
23	Parameter Block Offset	DV	18.1
24	ROM Flag	DF	18.4
25	**Effect Type**	NAry	18.4.1
26	ET Constant-Force	Sel	18.4.1
27	ET Ramp	Sel	18.4.1
28	ET Custom-Force	Sel	18.4.1
29-2F	*Reserved*		
30	ET Square	Sel	18.4.1
31	ET Sine	Sel	18.4.1
32	ET Triangle	Sel	18.4.1
33	ET Sawtooth Up	Sel	18.4.1
34	ET Sawtooth Down	Sel	18.4.1
35-3F	*Reserved*		
40	ET Spring	Sel	18.4.1
41	ET Damper	Sel	18.4.1
42	ET Inertia	Sel	18.4.1
43	ET Friction	Sel	18.4.1
44-4F	*Reserved*		
50	Duration	DV	18.4
51	Sample Period	DV	18.4
52	Gain	DV	18.4
53	Trigger Button	DV	18.4
54	Trigger Repeat Interval	DV	18.4
55	Axes Enable	US	18.4
56	Direction Enable	DF	18.4

57	**Direction**	CL	18.4
58	**Type Specific Block Offset**	CL	18.4
59	**Block Type**	NAry	18.4
5A	**Set Envelope Report**	CL/SV	18.5
5B	Attack Level	DV	18.5
5C	Attack Time	DV	18.5
5D	Fade Level	DV	18.5
5E	Fade Time	DV	18.5
5F	**Set Condition Report**	CL/SV	18.6
60	Center-Point Offset	DV	18.6
61	Positive Coefficient	DV	18.6
62	Negative Coefficient	DV	18.6
63	Positive Saturation	DV	18.6
64	Negative Saturation	DV	18.6
65	Dead Band	DV	18.6
66	**Download Force Sample**	CL	18.10.2
67	Isoch Custom-Force Enable	DF	18.10.2
68	**Custom-Force Data Report**	CL	18.10.1
69	Custom-Force Data	DV	18.10.1
6A	Custom-Force Vendor Defined Data	DV	18.10.1
6B	**Set Custom-Force Report**	CL/SV	18.10
6C	Custom-Force Data Offset	DV	18.10
6D	Sample Count	DV	18.10
6E	**Set Periodic Report**	CL/SV	18.7
6F	Offset	DV	18.7
70	Magnitude	DV	18.7
71	Phase	DV	18.7
72	Period	DV	18.7
73	**Set Constant-Force Report**	CL/SV	18.8
74	**Set Ramp-Force Report**	CL/SV	18.9
75	Ramp Start	DV	18.9
76	Ramp End	DV	18.9
77	**Effect Operation Report**	CL	18.11
78	**Effect Operation**	NAry	18.11.1
79	Op Effect Start	Sel	18.11.1
7A	Op Effect Start Solo	Sel	18.11.1
7B	Op Effect Stop	Sel	18.11.1
7C	Loop Count	DV	18.11
7D	**Device Gain Report**	CL	18.12
7E	Device Gain	DV	18.12
7F	**Parameter Block Pools Report**	CL	18.3.1
80	RAM Pool Size	DV	18.3.1
81	ROM Pool Size	SV	18.3.1

82	ROM Effect Block Count	SV	18.3.1
83	Simultaneous Effects Max	SV	18.3.1
84	Pool Alignment	SV	18.3.1
85	**Parameter Block Move Report**	CL	18.3.1
86	Move Source	DV	18.3.1
87	Move Destination	DV	18.3.1
88	Move Length	DV	18.3.1
89	**Effect Parameter Block Load Report**	CL	18.3.2
8A-8A	*Reserved*		
8B	**Effect Parameter Block Load Status**	NAry	18.3.2.1
8C	Block Load Success	Sel	18.3.2.1
8D	Block Load Full	Sel	18.3.2.1
8E	Block Load Error	Sel	18.3.2.1
8F	Block Handle	DV	18.3.2
90	**Effect Parameter Block Free Report**	CL	18.3.2
91	**Type Specific Block Handle**	CL	18.3.2
92	**PID State Report**	CL	18.13
93-93	*Reserved*		
94	Effect Playing	DF	18.13
95	**PID Device Control Report**	CL	18.14
96	**PID Device Control**	NAry	18.14.1
97	DC Enable Actuators	Sel	18.14.1
98	DC Disable Actuators	Sel	18.14.1
99	DC Stop All Effects	Sel	18.14.1
9A	DC Reset	Sel	18.14.1
9B	DC Pause	Sel	18.14.1
9C	DC Continue	Sel	18.14.1
9D-9E	*Reserved*		
9F	Device Paused	DF	18.14
A0	Actuators Enabled	DF	18.14
A1-A3	*Reserved*		
A4	Safety Switch	DF	18.14
A5	Actuator Override Switch	DF	18.14
A6	Actuator Power	OOC	18.14
A7	Start Delay	DV	18.4
A8	**Parameter Block Size**	CL	18.3.1
A9	Device-Managed Pool	SF	18.3.1
AA	Shared Parameter Blocks	SF	18.3.1
AB	**Create New Effect Parameter Block Report**	CL	18.3.2
AC	RAM Pool Available	DV	18.3.2
AD-FFFF	*Reserved*		

Table 18.1: Physical Input Device Page

18.1 Physical Input Devices

Usage Name	Usage Type	Description
Physical Input Device	CA	A collection of PID usages.
Normal	DV	A force applied perpendicular to the surface of an object.
Parameter Block Offset	DV	**Host-Managed** memory model: Usage represents the byte offset into the **Parameter Block Pool** where the **Parameter Block** is to be stored. **Device-Managed** memory model: Usage represents an index of the target axis. The order of axis declaration in the **Axes Enable** collection defines the index.

18.2 Parameter Blocks

Effects are described with multiple **Parameter Blocks**:- a single **Effect Parameter Block**, and 1 (or more) **Type-Specific Parameter Blocks** (for Effect-specific parameters). Splitting the Effect configuration into multiple **Parameter Blocks** allows for the sharing of common blocks amongst Effects (minimizing **Parameter Block Pool** utilization, i.e. the Device RAM) and enabling more efficent memory-packing.

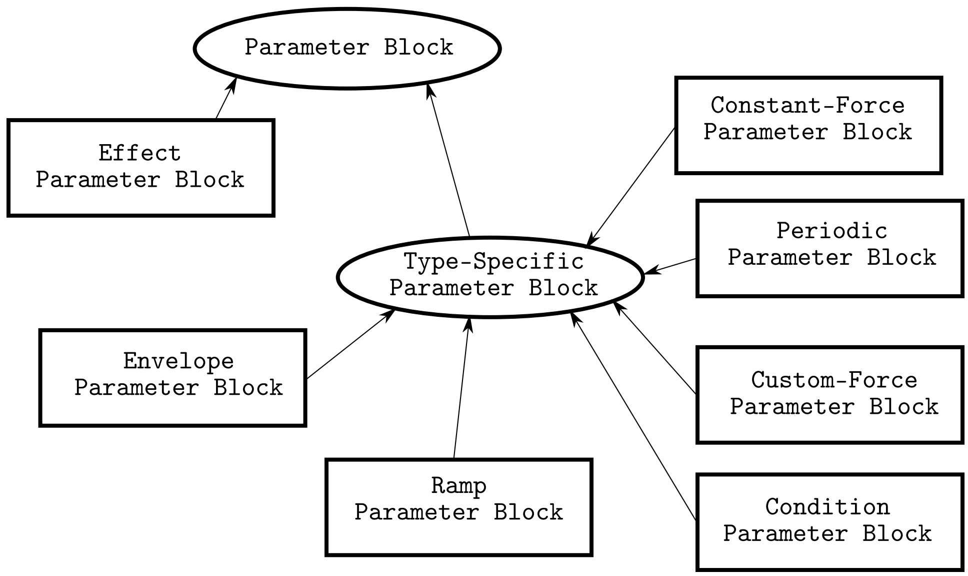


Figure 18.1: **Parameter Block** type hierarchy

Each predefined **Effect Type** requires/permits different **Type-Specific Parameter Blocks**:-

1. **ET Custom-Force** Effects cannot specify an **Envelope Parameter Block**
2. Effects using **Condition Parameter Blocks** cannot specify an **Envelop Parameter Block**
3. Effects using **Condition Parameters Blocks** require 1 **Condition Parameter Block** per axis.
4. Effects that do not use **Condition Parameters Blocks** use 1 **Type-Specific Parameter Block** and 1 optional **Envelope Parameter Block**
5. Rules 2-4 apply to each declared joint

The number of **Type-Specific Parameter Blocks** equals the number of joints times the number of axes, or 2; whichever is greater. The minimum of 2 will support an **Envelope Parameter Blocks** and one additional **Type-Specific Parameter Block**.

$$\#\text{TypeSpecific Parameter Blocks} = \#\text{Joints} \times \max(\#\text{Axes}, 2) \tag{18.1}$$

Effect Type[1]	**Type-Specific Parameter Block 1**	**Type-Specific Parameter Block 2**
ET Constant-Force	Constant-Force	Envelope (optional)
ET Ramp	Ramp	Envelope (optional)
ET Square	Periodic	Envelope (optional)
ET Sine	Periodic	Envelope (optional)
ET Triangle	Periodic	Envelope (optional)
ET Sawtooth Up	Periodic	Envelope (optional)
ET Sawtooth Down	Periodic	Envelope (optional)
ET Spring	Condition (Axis X)[2]	Condition (Axis Y)[2]
ET Damper	Condition (Axis X)[2]	Condition (Axis Y)[2]
ET Intertia	Condition (Axis X)[2]	Condition (Axis Y)[2]
ET Friction	Condition (Axis X)[2]	Condition (Axis Y)[2]
ET Custom-Force	Custom-Force Data	N/A

Table 18.3: **Effect Types** and valid **Type-Specific Parameter Blocks**

[1] All Effect Types as defined in 18.4.1 Effect Types

[2] Assumed here there is a single joint with two axes X, Y. If the device had 3 axes, then a third **Type-Specific Parameter Block** would be declared for those Effects that use the third axis. Similarly, if a device only had a only a single axis, then only a single **Type-Specific Parameter Block** would be declared for that axis.

18.3 Parameter Block Management

All **Parameter Blocks** are downloaded-to/stored-in the Device RAM **Parameter Block Pool** (i.e. a specially set-aside Device RAM allocation, with enough room for many blocks). The Device is configured to operate the pool with either a **Host-Managed** or **Device-Managed** memory-model (see **Device-Managed Pool**).

> **Host-Managed**: The Device provides a contiguous block of memory and the Host decides what/where **Parameter Blocks** are stored.
>
> **Device-Managed**: The Device allocates **Parameter Blocks** into the pool itself (at the request of the Host), responding with unique assigned ids or errors if insuffcent memory available.

The Device may also have a ROM **Parameter Block Pool**, where the blocks are read-only, and can be interrogated by the Host to determine supported Effects.

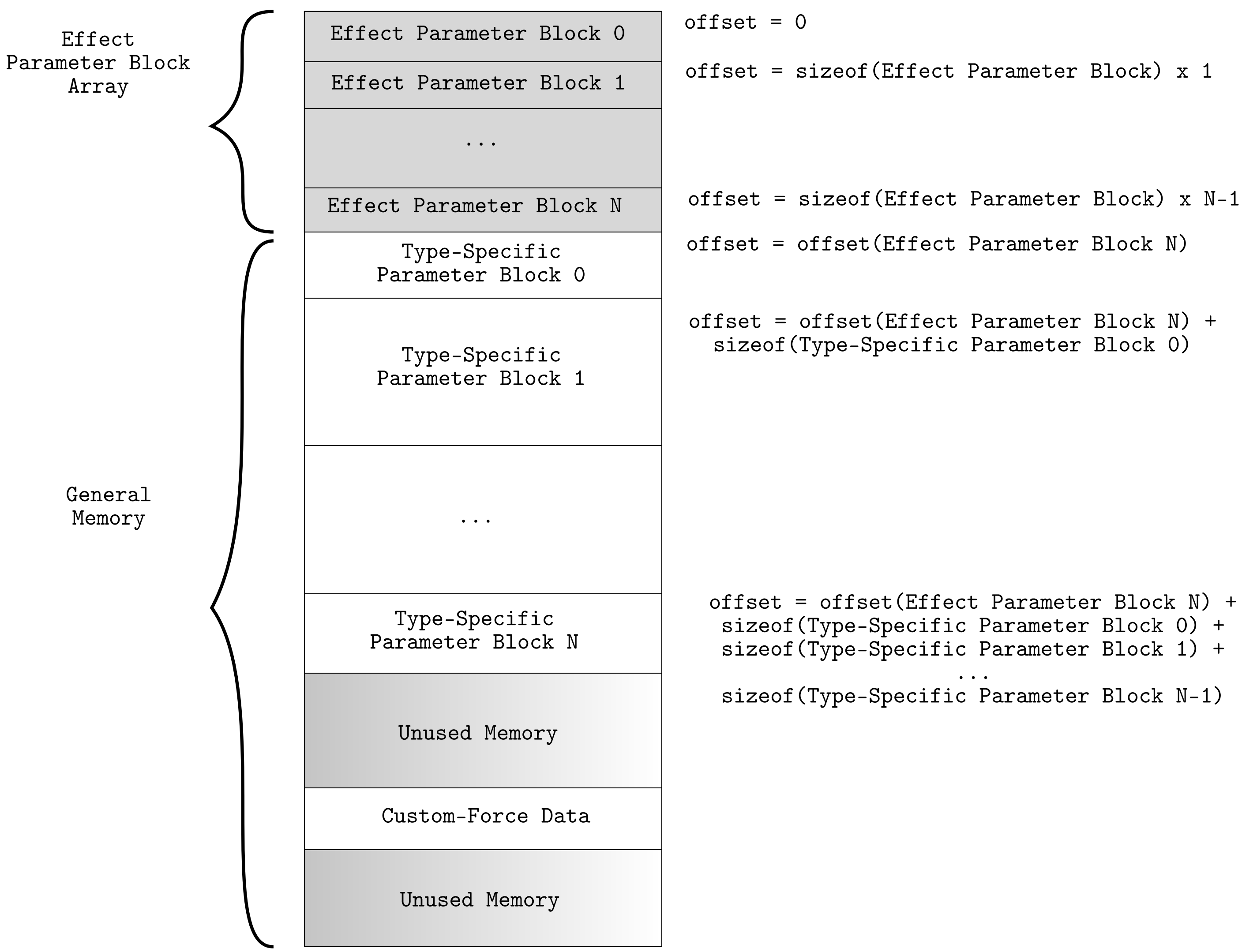


Figure 18.2: RAM/ROM **Parameter Block Pool** Layout

18.3.1 Host-Managed

The Host uses the **Parameter Block Pools Report** to identify the pool size of the RAM and ROM **Parameter Block Pools** and the size of individual **Parameter Blocks**. As shown in 18.2 RAM/ROM **Parameter Block Pool** Layout the RAM **Parameter Block Pool** is conceptually divided into two areas the **Effect Parameter Block Array** and **General Memory**.

> **Effect Parameter Blocks** in the **Effect Parameter Block Array** are allocated by issuing **Set Effect Reports** (see 18.4 Effect Parameter Block), with a Host-assigned unique **Effect Parameter Block Index**. This unique index is later used to refer to the specific Effect. *Note: Indexes can be used here (rather than memory-offsets) as all blocks in this array are the same size, and are allocated contiguously, at the start of the pool.*
>
> **Type-Specific Parameter Blocks** are allocated in **General Memory** with a type-specific report (e.g. 18.5 Envelope Parameters Block) and addressed with a unique **Parameter Block Offset**. This offset points to the first byte in the RAM **Parameter Block Pool** of the allocation. *Note: Special care must be taken when calculating offsets, taking into account the size and location of previous allocations (including the size of the **Effect Parameter Block Array**).*

The allocation size for each **Parameter Block** type is declared in the **Parameter Block Size** CL. *Note: The size of the allocation is always the same as the report size of the specific type **minus** the size of the ReportId and **Effect Parameter Block Index/Parameter Block Offset** fields.*

The Host maintains a list of currently stored **Parameter Blocks** and is responsible for block garbage collection. To 'remove' an allocation in the **Effect Parameter Block Array** or **General Memory**, the Host need only 'forget' about it's allocation, and either never refer (again) to the allocated Effect, or overwrite with a new **Parameter Block**. Over the Device lifetime, this will result in fragmentation of the pool, so **Parameter Block Move Report** can be used to efficently re-arrange blocks. Alternatively, the Device can be reset (see 18.14.1 PID Device Control), where all Effects are removed.

ROM-based effects are supported by having read-only equivalents to retrieve **Parameter Blocks** to determine Effects stored on the device.

Usage Name	Usage Type	Description
Parameter Block Pools Report	CL	Identifies the report associated with retrieving pool settings.
RAM Pool Size	DV	The size of the RAM **Parameter Block Pool** in bytes.
ROM Pool Size	SV	The size of the ROM **Parameter Block Pool** in bytes.
ROM Effect Block Count	SV	The number of ROM **Effect Parameter Blocks** in the ROM **Parameter Block Pool**.
Simultaneous Effects Max	SV	The maximum number of simultaneous effects (i.e. total effects that can be executed at one time). *Note: This is not the same as the number of Effects that can be stored. Such is subject only to memory availablity.*
Pool Alignment	SV	The **Parameter Block** start address alignment boundary in bytes (valid values, 1, 2, 4). If undefined, 1byte alignment is assumed.
Parameter Block Size	CL	Collection of sizes the Host must allocate for each fixed-size **Parameter Block** type (i.e. all except for **Custom-Force Data Parameter Block**).
Device-Managed Pool	SF	Asserted if the memory-model for the RAM **Parameter Block Pool** is **Device-Managed**. Otherwise, **Host-Managed**.
Shared Parameter Blocks	SF	Asserted if the Device supports a single **Type-Specific Parameter Block** being shared between multiple Effects (This can be useful to reduce pool utilization). Otherwise, not supported.

Parameter Block Move Report	CL	Identifies the report associated with moving **Type-Specific Parameter Blocks** in the RAM **Parameter Block Pool**. The Host must update affected **Effect Parameter Block** references. *Note: Moving a* ***Type-Specific Parameter Block*** *that is referenced by a playing Effect will result in undefined behaviour.*
Move Source	DV	The source offset of the **Type-Specific Parameter Block**
Move Destination	DV	The destination offset of the **Type-Specific Parameter Block**
Move Length	DV	The size of the **Type-Specific Parameter Block** to move in bytes.

18.3.2 Device-Managed

When the pool is **Device-Managed**, the creation of all **Parameter Blocks** are done entirely by the Device.

> **Effect Parameter Blocks** are created with **Create New Effect Parameter Block Report** specifying the **Effect Type**. (If this is a **ET Custom-Force**, then a **Generic Desktop**:**Byte Count** Usage must also be specified.) The Host then requests an **Effect Parameter Block Load Report** to retrieve the **Effect Parameter Block Load Status**, the newly assigned unique **Effect Parameter Block Index** (if successfully loaded), and the available RAM (**RAM Pool Available**). After creation (just as in **Host-Managed**), a **Set Effect Report** is sent (with a previously retreived **Effect Parameter Block Index**), to configure the new Effect. *Note: **Type Specific Block Offsets** are not specified in the Effect configuration. Linking Effects to their additional **Type-Specific Parameter Blocks** is instead done by the type-specific report.*

> **Type-Specific Parameter Blocks** are (similarly to **Host-Managed**) created with a type-specific report (e.g. 18.5 Envelope Parameters Block), but instead of specifing the **Parameter Block Offset**, an **Effect Parameter Block Index** is specified. The Device will create the **Type-Specific Parameter Block** at some internal offset, and internally 'link' it to the specified Effect. The lifetime of this block is bound to the lifetime of the linked **Effect Parameter Block**. To link **Condition Parameter Blocks**, the type-specific report must additionally have a **Parameter Block Offset**, but instead of referring to an offset, refers to an index of a target axis (this is needed because multiple **Condition Parameter Blocks** could be part of the same Effect; unlike other type-specific blocks.)

Usage Name	Usage Type	Description
Create New Effect Parameter Block Report	CL	Identifies the report associated with creating a new Effect in a **Device-Managed** RAM **Parameter Block Pool**.
Effect Parameter Block Load Report	CL	Identifies the report associated with a Device's response to a **Create New Effect Parameter Block Report**.
Effect Parameter Block Free Report	CL	Identifies the report associated with freeing an **Effect Parameter Block**, that was created with a **Create New Effect Parameter Block Report**.
RAM Pool Available	DV	The number of bytes remaining in the RAM **Parameter Block Pool**.
Block Handle	DV	*Deprecated: Do not use.*
Type Specific Block Handle	CL	*Deprecated: Do not use.*

18.3.2.1 Block Status

Usage Name	Usage Type	Description
Effect Parameter Block Load Status	NAry	Identifies the completion status of a **Create New Effect Parameter Block Report**.
Block Load Success	Sel	The **Create New Effect Parameter Block Report** succeeded.
Block Load Full	Sel	The **Create New Effect Parameter Block Report** failed to complete because there was no room in the RAM **Parameter Block Pool**.
Block Load Error	Sel	The **Create New Effect Parameter Block Report** failed to complete because an error occurred in the Device.

18.4 Effect Parameter Block

An **Effect Parameter Block** is the definition of an individual Effect (i.e. each block corresponds to a single Effect) and contains the parameters each Effect must have. Blocks are created with **Set Effect Report** and stored in the Device **Effect Parameter Block Array**.

Additional parameters, common amongst subsets of **Effect Types** are described with additional **Type-Specific Parameter Blocks** (see Table 18.3 **Effect Types** and valid **Type-Specific Parameter Blocks**).

Usage Name	Usage Type	Description
Set Effect Report	CL/SV	Identifies the report associated with creating an new Effect and settings it's basic parameters. Is used as an SV when part of the **Parameter Block Size** CL.
Effect Parameter Block Index	DV	Uniquely identifies an Effect, by it's defined position/index in the **Effect Parameter Block Array**. Varies from 1 to the maximum number of Effects stored on the Device. See 18.3 Parameter Block Management .
ROM Flag	DF	Distinguishes between RAM and ROM based **Effect Parameter Blocks**.
Duration	DV	The total duration of the Effect. To sustain an Effect until explicitly stopped (e.g. with **Op Effect Stop**), set Duration to INFINITE (Null). If an Envelope has been applied to the Effect, then the attack will be applied, followed by an infinite sustain. *Note: no time dimension is pre-defined; Unit must be explicitly defined.*
Sample Period	DV	The period at which the device should playback the Effect. A value of 0 indicates that the default playback sample rate should be used. If the device is not capable of playing back the Effect at the specified rate, it will choose the supported rate that is closest to the requested value. Setting a custom Sample Period can be used for special effects. For example, playing a sine wave at an artificially large sample period results in a rougher texture. *Note: no time dimension is pre-defined; Unit must be explicitly defined.*
Gain	DV	The gain to be applied to the Effect. This is a normalized scaling factor that is applied to all **Constant-Force Parameter Blocks** and **Envelop Parameter Blocks** of an Effect.
Trigger Button	DV	The identifier or offset of the button to be used to trigger playback of this effect. A Null Trigger Button value indicates that this Effect is not tied to a button.
Trigger Repeat Interval	DV	The auto-repeat interval, for playback of effects triggered by holding down the trigger button. The interval is the time between the end of the playing effect and start of the next effect. If this effect is a one-time effect (no auto-repeat is desired), this value should be set to INFINITE (Null). *Note: no time dimension is pre-defined; Unit must be explicitly defined.*
Axes Enable	US	Contains joint collections. Each joint collection contains axes or vectors from Generic Desktop Page (`0x01`). Types of these Usages are changed to Dynamic Flags (DF) where each Usage identifies whether the respective axis or vector is enabled for this effect.

Direction Enable	DF	If set then the Axes Enable flags are ignored, only one **Condition Parameter Block** is defined and the Direction is applied to the block as a polar direction.
Direction	CL	Contains joint collections. Each joint collection contains axes or vectors from Generic Desktop Page `(0x01)`. Each axis usage is treated as a Dynamic Variable (DV). If the values are in Cartesian coordinates then axes usages X, Y or Z or vector usages Vx, Vy or Vz will be declared in this collection as normalized values. If the values are in polar coordinates then axes usages Rx, Ry or Rz or vector usages Vbrx, Vbry or Vbrz will be declared in this collection as normalized values.
Type Specific Block Offset	CL	Ordinal Collection to distinguish individual **Type Specific Block Offset** fields. The **Effect Type** determines whether 1 (or more) fields are valid.
Block Type	NAry	*Deprecated: Do not use.*
Start Delay	DV	The start delay interval, for the playback of Effect. The interval is the time between an **Op Effect Start** or **Op Effect Start Solo** command and initiation of the Effect. If no delay is desired this value should be set to 0. *Note: no time dimension is pre-defined; Unit must be explicitly defined.*

18.4.1 Effect Types

Included in a **Set Effect Report** to identify the **Effect Type**, and which **Type-Specific Parameter Blocks** are expected.

Usage Name	**Usage Type**	**Description**
Effect Type	NAry	Identifies the Type of Effect the command defines. Vendor defined effect type selectors can also be included in this collection.
ET Constant-Force	Sel	Defines a Constant waveform.
ET Ramp	Sel	Defines a Ramp waveform.
ET Square	Sel	Defines a Square waveform.
ET Sine	Sel	Defines a Sine waveform.
ET Triangle	Sel	Defines a Triangle waveform.
ET Sawtooth Up	Sel	Defines a Sawtooth Up waveform.
ET Sawtooth Down	Sel	Defines a Sawtooth Down waveform.
ET Spring	Sel	Defines a compliant restoring force that causes the device to return to a specified point in the device's range of motion.
ET Damper	Sel	Defines a Damper effect.
ET Inertia	Sel	Defines a Inertia effect.
ET Friction	Sel	Defines a Friction effect.
ET Custom-Force	Sel	Defines a downloaded Custom-Force waveform. Custom-Forces are analogous to audio sound files, as they describe custom-waveforms that 'played' by the Device.

18.5 Envelope Parameters Block

Describes an Envelope to apply to an Effect. An Envelope is a convenient mechanism to Fade in-to/out-of an Effect.

Usage Name	Usage Type	Description
Set Envelope Report	CL/SV	Identifies the report associated with setting Envelope parameters. Is used as an SV when part of the **Parameter Block Size** CL.
Attack Level	DV	Normalized amplitude for the start of the Envelope (from the baseline).
Attack Time	DV	The transition time to reach the sustain level. *Note: no time dimension is pre-defined; Unit must be explicitly defined.*
Fade Level	DV	Normalized amplitude to end the Envelope (from the baseline).
Fade Time	DV	The fade time to reach the fade level. *Note: no time dimension is pre-defined; Unit must be explicitly defined.*

18.6 Condition Parameters Block

Each Effect will interpret condition parameters differently, but commonly the force resulting from a condition is:-

$$\text{force} = A(q - q0) \tag{18.2}$$

where:-

A is a scaling coeffiicent

q is an **Effect Type** specific metric

Effect Type	Metric
ET Spring	Axis Position
ET Damper	Axis Velocity
ET Inertia	Axis Acceleration

q0 is the neutral value for that metric

The simplified formula given above must be adjusted if a non-zero dead band is provided. If the metric is less than (Center-Point Offset – Dead Band), then the resulting force is:-

$$\text{force} = \text{Negative Coefficient} \times (q - (\text{Center-Point Offset} - \text{Dead Band})) \tag{18.3}$$

Similarly, if the metric is greater than (Center-Point Offset + Dead Band), then the resulting force is:-

$$\text{force} = \text{Positive Coefficient} \times (q - (\text{Center-Point Offset} + \text{Dead Band})) \tag{18.4}$$

If #**Condition Parameter Blocks** = #Axes for an Effect, then the first block applies to the first axis, the second applies to the second axis (and so on). When a block is defined for each axis this way, the Effect must not be rotated.

If there is a single **Condition Parameter Block** for an Effect with more than one axis, then the direction along which the parameters of the block are in-effect is determined by the direction parameter passed in **Direction** of the **Effect Parameter Block**.

Usage Name	Usage Type	Description
Set Condition Report	CL/SV	Identifies the report associated with setting the Condition parameters. Is used as an SV when part of the **Parameter Block Size** CL.
Center-Point Offset	DV	The Normalized Center-Point Offset. Offset from axis 0 position.
Positive Coefficient	DV	The Normalized coefficient constant on the positive side of the neutral position.
Negative Coefficient	DV	The Normalized coefficient constant on the negative side of the neutral position.
Positive Saturation	DV	The Normalized maximum positive force output.
Negative Saturation	DV	The Normalized maximum negative force output.
Dead Band	DV	The region around **Center-Point Offset** where the condition is not active. (i.e. In other words, the condition is not active between (Offset - Dead Band) and (Offset + Dead Band)). This value is Normalized.

18.7 Periodic Parameters Block

Describes a wave function to use as the base of an Effect. Once started, the Effect will loop every **Period**.

Usage Name	Usage Type	Description
Set Periodic Report	CL/SV	Identifies the report associated with setting the Periodic parameters. Is used as an SV when part of the **Parameter Block Size** CL.
Offset	DV	Normalized baseline offset. The range of forces generated by the effect are (Offset - Magnitude) to (Offset + Magnitude). The value of the Offset member is also the baseline for any Envelope that is applied to the Effect.
Magnitude	DV	Normalized magnitude of the Effect. If an Envelope is applied to this Effect, then the value represents the magnitude of the Envelope. If no Envelope is applied, then the value represents the amplitude of the entire Effect.
Phase	DV	Determines the position in the wave that playback begins. This is a normalized value between 0 and 360 degrees. The angular increment is defined by the resolution of this field. A Host may not provide support for all values of Phase. In this case the value will be rounded-off to the nearest supported value.
Period	DV	The period of the wave. *Note: no time dimension is pre-defined; Unit must be explicitly defined.*

18.8 Constant-Force Parameters Block

Describes a constant force for the actuator to apply.

Usage Name	Usage Type	Description
Set Constant-Force Report	CL/SV	Identifies the report associated with setting the Constant-Force parameters. *Must* contain **Magnitude** Usage. Is used as an SV when part of the **Parameter Block Size** CL.

18.9 Ramp-Force Parameters Block

Usage Name	Usage Type	Description
Set Ramp-Force Report	CL/SV	Identifies the report associated with setting Ramp-Force parameters. Is used as an SV when part of the **Parameter Block Size** CL.
Ramp Start	DV	The Normalized magnitude at the start of the Effect.
Ramp End	DV	The Normalized magnitude at the end of the Effect.

18.10 Custom-Force Parameter Block

All **Effect Parameter Blocks** use additional **Type-Specific Parameter Blocks** to specify Effect type-specific parameters. This allows the sharing of these larger blocks amongst multiple Effects, better utilizing Device memory.

Similarly, **Custom-Force Parameter Blocks** themselves store waveform sample-data in a seperate memory location (at **Custom-Force Data Offset**), distinct from the block. This allows for the samples to be shared amongst multiple blocks, to better utilize Device memory. Sample data is transferred with **Custom-Force Data Report**.

> *Note: **Custom-Force Parameter Blocks** are used exclusively by **ET Custom-Forces**.*

Usage Name	Usage Type	Description
Set Custom-Force Report	CL/SV	Identifies the report associated with setting the Custom-Force parameters. *Note: **Custom-Force Parameter Blocks** can never be pre-defined on a Device (i.e. must be in RAM), so a **ROM Flag** should never be declared.* Is used as an SV when part of the **Parameter Block Size** CL.
Custom-Force Data Offset	DV	Offset into the **Parameter Block Pool** where the **Custom-Force Data** starts.
Sample Count	DV	The number of **Custom-Force Data** samples in a single Effect period.

18.10.1 Downloading Samples

All samples transferred with **Custom-Force Data Report** are packed, and a sample may not necessarily be an integral number of bytes in length. (or, conversely, **Custom-Force Data** may not be an integral number of samples in length, so a sample may not end on a byte-boundary.).

If the sample data required in the Device is larger than the **Custom-Force Data**, then sequential **Custom-Force Data** will be transferred, and samples may span multiple **Custom-Force Data**. If so, the **Custom-Force Data** must be 'Buffered Bytes'.

Usage Name	Usage Type	Description
Custom-Force Data Report	CL	Identifies the report associated with downloading **Custom-Force Data**.
Custom-Force Data	DV	Packed sample data with the format that of a **Download Force Sample** CL found in the same descriptor. Units may be used to define the force value, otherwise assumed to be a normalized value.
Custom-Force Vendor Defined Data	DV	Similiar to **Custom-Force Data**, but sample format is vendor-defined, so a **Download Force Sample** CL definition is not used.

18.10.2 Sample Definition

Declares the format of a sample, multiple samples will be packed into a **Custom-Force Data**. A sample consists of one or more axes.

The size of the sample is a function of the number of axes and the size of their respective bit fields.

Usage Name	Usage Type	Description
Download Force Sample	CL	Contains joint-collections that define the format of the sample.
Isoch Custom-Force Enable	DF	*Deprecated: Do not use.*

18.11 Effect Operations

When an **Effect Parameter Block** (i.e. an Effect) is added to the **Effect Block Parameter Array**, it is initially Stopped.

After any additional **Type-Specific Parameter Blocks** are downloaded, the Effect can be Started.

After the duration of the Effect has elapsed (and iterations Played), the Effect will return to the Stopped state.

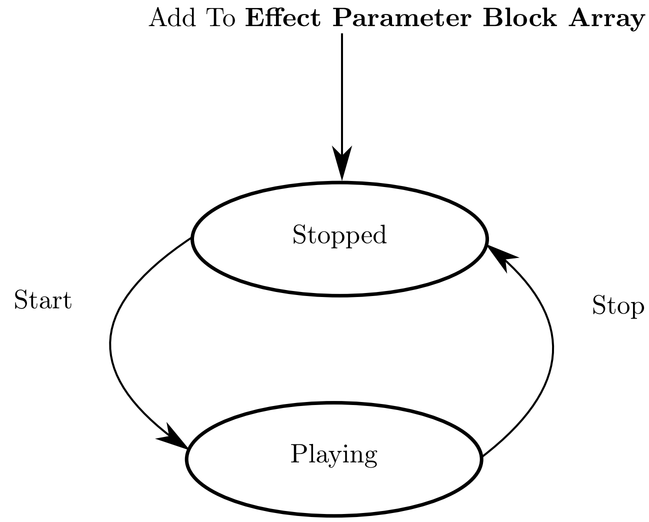


Figure 18.3: Effect Operation

Usage Name	Usage Type	Description
Effect Operation Report	CL	Identifies the report associated with setting Effect operational parameters.
Loop Count	DV	The number of times the Device will repeat the Effect (so a **Op Effect Stop** is not required.). An INFINITE value implies *loop forever*.

18.11.1 Effect Operation

Usage Name	Usage Type	Description
Effect Operation	NAry	Operation to perform on the Effect identified by **Effect Parameter Block Index**
Op Effect Start	Sel	Starts the Effect identified by **Effect Parameter Block Index**
Op Effect Start Solo	Sel	Starts the Effect identified by **Effect Parameter Block Index** and Stops *all* other Effects on the Device.
Op Effect Stop	Sel	Stops the Effect identified by **Effect Parameter Block Index**.

18.12 Device Gain

Usage Name	**Usage Type**	**Description**
Device Gain Report	CL	Identifies the report associated with setting gain parameters.
Device Gain	DV	The gain to be applied to all Effects on the Device. The gain is a normalizing scaling factor applied to all **Magnitudes** and Envelopes of an Effect, scaling the final output of the Device.

18.13 PID State

Always sent in response to a **PID Device Control Report**, or when other, underlying state has changed.

Usage Name	Usage Type	Description
PID State Report	CL	Identifies the report associated with identifying PID state.
Effect Playing	DF	Indicates the current Play-State for an Effect. If asserted, the Effect is currently playing. If cleared, the Effect is not currently playing (i.e. Stopped).
Device Paused	DF	Indicates if all Effects are Paused.
Actuators Enabled	DF	Indicates if Device actuators are enabled.
Safety Switch	DF	Indicates the state of the Safety-Switch.
Actuator Override Switch	DF	Actuator override switch, available to the user. The user enables the Device's actuators if this is asserted.
Actuator Power	OOC	Indicates the current actuator power status.

18.14 PID Device Control

Usage Name	Usage Type	Description
PID Device Control Report	CL	Identififes the report associated with executing Device control commands. These affect the entire Device and require no additional parameters.

18.14.1 PID Device Control

Usage Name	Usage Type	Description
PID Device Control	NAry	Device-wide state controls.
DC Enable Actuators	Sel	Enable all actuators.
DC Disable Actuators	Sel	Disable all actuators.
DC Stop All Effects	Sel	Issues a Stop to every running Effect.
DC Reset	Sel	Clears any Device paused condition, enables all actuators and clears all Effects from memory.
DC Pause	Sel	All Effects are paused at the current time-step.
DC Continue	Sel	All Effects previously Paused are started from their last time step.

19 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).

20 SoC Page (0x11)

SoC devices describe management/control interfaces to a SoC (System-On-Chip) and its distinct embedded devices.

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**SocControl**	CA	20.1
02	**FirmwareTransfer**	CL	20.2
03	FirmwareFileId	DV	20.2
04	FileOffsetInBytes	DV	20.2
05	FileTransferSizeMaxInBytes	DV	20.2
06	FilePayload	DV	20.2
07	FilePayloadSizeInBytes	DV	20.2
08	FilePayloadContainsLastBytes	DF	20.2
09	FileTransferStop	DF	20.2
0A	FileTransferTillEnd	DF	20.2
0B-FFFF	*Reserved*		

Table 20.1: SoC Page

20.1 SoC Control Device

Usage Name	Usage Type	Description
SocControl	CA	A device that provides basic control over a microcontroller/SoC (System-on-chip).

20.2 Firmware Transfer

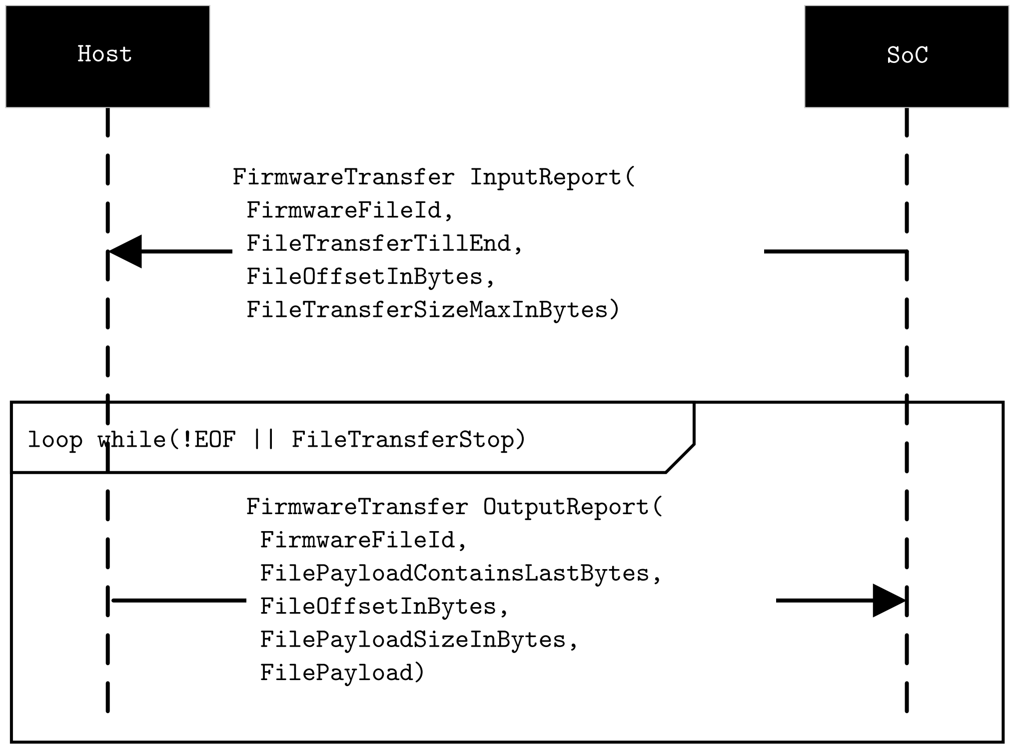
The below Usages describe how a SoC can request specific firmware files from a Host. A SoC may utilize multiple firmware files itself and/or retrieve on behalf of other attached-devices. As underlying transports have different maximum report sizes (e.g. USB == max(USHORT)) large files are expected to be split over multiple reports.

Note: It is not defined how the Host previously received the firmware files to transfer, or how the Host associates a particular file with a FirmwareFileId.

Having the SoC retrieve significant parts of its firmware (or for attached-devices) from the Host (e.g. at boot-time), can reduce the need for SoC-specific persistent storage. By instead relying on the Host (using it's larger+cheaper persistent storage) significant cost-savings may be realized.

Usage Name	**Usage Type**	**Description**
FirmwareTransfer	CL	Contains controls used to transfer firmware of a SoC (or a distinct embedded-device attached to the SoC).
FirmwareFileId	DV	Identifier for a specific Firmware file. Id == 0 is undefined. A SoC may have multiple firmware files (depending on its current application), or requests on-behalf of distinct attached embedded-devices. *Note: It is not defined how the SoC/Host establish the common file identifier.*
FileOffsetInBytes	DV	Offset (in bytes) from the start of the file. *In conjunction with FileTransferSizeMaxInBytes this allows a SoC to request only part of a file (e.g. because only a portion of SoC RAM is available and an internal firmware transfer is still pending).*
FileTransferSizeMaxInBytes	DV	Maximum bytes of the file to be transferred. This can vary across requests and may not be reached if the actual file size is less than specified. *In conjunction with FileOffsetInBytes this allows a SoC to request only part of a file (e.g. because only a portion of SoC RAM is available and an internal firmware transfer is still pending).*
FilePayload	DV	The actual (partial) File payload. May be split over multiple reports.
FilePayloadSizeInBytes	DV	Number of valid bytes of FilePayload. *Note: This is expected to be LogicalMax until the last transfer, which may only use part of the available FilePayload item.*
FilePayloadContainsLastBytes	DF	Indicates if the payload contains the last bytes of the file. When false, indicates more Output Reports should be expected. *Note: This flag is used as an alternative to specifying the actual size of the File, which the SoC could use to determine whether a report was the final expected one.*
FileTransferStop	DF	Indicates the current transfer should stop.

FileTransferTillEnd	DF	Indicates whether the SoC expects the Host to send only a single FilePayload report (containing the maximum bytes from the requested Offset), or multiple FilePayload reports without further requests from the SoC. The transfer can be stopped at any time by 'FileTransferStop'



21 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	*Undefined*		
01	**Eye Tracker**	CA	21.1
02	**Head Tracker**	CA	21.1
03-0F	*Reserved*		
10	**Tracking Data**	CP	21.3
11	**Capabilities**	CL	21.2
12	**Configuration**	CL	21.5
13	**Status**	CL	21.6
14	**Control**	CL	21.7
15-1F	*Reserved*		
20	Sensor Timestamp	DV	21.1
21	Position X	DV	21.1
22	Position Y	DV	21.1
23	Position Z	DV	21.1
24	**Gaze Point**	CP	21.1
25	**Left Eye Position**	CP	21.1
26	**Right Eye Position**	CP	21.1
27	**Head Position**	CP	21.1
28	**Head Direction Point**	CP	21.1
29	Rotation about X axis	DV	21.1
2A	Rotation about Y axis	DV	21.1
2B	Rotation about Z axis	DV	21.1
2C-FF	*Reserved*		
100	Tracker Quality	SV	21.2
101	Minimum Tracking Distance	SV	21.3
102	Optimum Tracking Distance	SV	21.3
103	Maximum Tracking Distance	SV	21.3
104	Maximum Screen Plane Width	SV	21.4
105	Maximum Screen Plane Height	SV	21.4
106-1FF	*Reserved*		

200	Display Manufacturer ID	SV	21.5
201	Display Product ID	SV	21.5
202	Display Serial Number	SV	21.5
203	Display Manufacturer Date	SV	21.5
204	Calibrated Screen Width	SV	21.5
205	Calibrated Screen Height	SV	21.5
206-2FF	*Reserved*		
300	Sampling Frequency	DV	21.6
301	Configuration Status	DV	21.6
302-3FF	*Reserved*		
400	Device Mode Request	DV	21.7
401-FFFF	*Reserved*		

Table 21.1: Eye and Head Trackers Page

21.1 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
Eye Tracker	CA	Reports eye position and eye gaze point. *Default units are in micrometers for distances, and radians with five decimals for rotations.*
Head Tracker	CA	Reports the head direction point and head position. *Default units are in micrometers for distances, and radians with five decimals for rotations.*
Sensor Timestamp	DV	Sensor timestamp of the applicable physical collection. *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.*
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.
Gaze Point	CP	The location on the display the user is looking at. Contains the [X, Y] coordinates on the screen where the user is gazing.
Left Eye Position	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.
Right Eye Position	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.
Head Position	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.
Head Direction Point	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.

21.2 Capabilities Collection

Usage Name	Usage Type	Description
Capabilities	CL	This collection contains the capabilities of the sensor.
Tracker Quality	SV	This field provides guidance regarding the quality of the tracker. It is an enumeration whose values are described below. *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.* • 0 : N/A • 1 : Fine Gaze

Fine gaze: At least 95% of the Population has an Average Accuracy of $<2°$. 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.

21.3 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
Tracking Data	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.

21.4 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.

21.5 Configuration Collection

First four usages in this collection correspond to the layout of the Display Product Identification of the EDID[1]. 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
Configuration	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.

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

21.6 Status Collection

Usage Name	Usage Type	Description
Status	CL	Contains the current status of the device. *When the configuration status changes, the device should send an input report notifying the OS.*
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. • 1 : **Ready -** The device is configured and ready for use. • 2 : **Configuring -** The device is undergoing configuration. • 3 : **Screen Setup Needed -** Screen plane setup has not been performed on the device. • 4 : **User Calibration Needed -** The user needs to perform a calibration to make the device usable.

21.7 Control Collection

Usage Name	Usage Type	Description
Control	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. • 1 : **Enable Gaze Point -** Request device to provide gaze point data. • 2 : **Enable Eye Position -** Request device to provide eye position data. • 4 : **Enable Head Position -** Request device to provide head position data.

22 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	*Undefined*		
01	**Alphanumeric Display**	CA	22.1
02	**Auxiliary Display** [2]	CA	22.2
03-1F	*Reserved*		
20	**Display Attributes Report**	CL	22.1.1
21	ASCII Character Set	SF	22.1.1
22	Data Read Back	SF	22.1.1
23	Font Read Back	SF	22.1.1
24	**Display Control Report**	CL	22.1.2
25	Clear Display	DF	22.1.2
26	Display Enable	DF	22.1.2
27	Screen Saver Delay	SV/DV	22.1.2
28	Screen Saver Enable	DF	22.1.2
29	Vertical Scroll	SF/DF	22.1.3
2A	Horizontal Scroll	SF/DF	22.1.3
2B	**Character Report**	CL	22.1.4
2C	Display Data	DV	22.1.4
2D	**Display Status**	CL	22.1.5
2E	Stat Not Ready	Sel	22.1.5
2F	Stat Ready	Sel	22.1.5
30	Err Not a loadable character	Sel	22.1.5
31	Err Font data cannot be read	Sel	22.1.5
32	Cursor Position Report	Sel	22.1.6
33	Row	DV	22.1.6
34	Column	DV	22.1.6
35	Rows	SV	22.1.6
36	Columns	SV	22.1.6
37	Cursor Pixel Positioning	SF	22.1.6
38	Cursor Mode	DF	22.1.6
39	Cursor Enable	DF	22.1.6
3A	Cursor Blink	DF	22.1.6
3B	**Font Report**	CL	22.1.7
3C	Font Data	Buffered Bytes	22.1.7
3D	Character Width	SV	22.1.7
3E	Character Height	SV	22.1.7
3F	Character Spacing Horizontal	SV	22.1.7

40	Character Spacing Vertical	SV	22.1.7
41	Unicode Character Set	SF	22.1.1
42	Font 7-Segment	SF	22.1.1
43	7-Segment Direct Map	SF	22.1.1
44	Font 14-Segment	SF	22.1.1
45	14-Segment Direct Map	SF	22.1.1
46	Display Brightness	DV	22.1.2
47	Display Contrast	DV	22.1.2
48	**Character Attribute**	CL	22.1.1
49	Attribute Readback	SF	22.1.1
4A	Attribute Data	DV	22.1.4
4B	Char Attr Enhance	OOC	22.1.1
4C	Char Attr Underline	OOC	22.1.1
4D	Char Attr Blink	OOC	22.1.1
4E-7F	*Reserved*		
80	Bitmap Size X [2]	SV	22.2.1
81	Bitmap Size Y [2]	SV	22.2.1
82	Max Blit Size [2]	SV	22.2.4
83	Bit Depth Format [2]	SV	22.2
84	Display Orientation [2]	DV	22.2.2
85	**Palette Report** [2]	CL	22.2.3
86	Palette Data Size [2]	SV	22.2.3
87	Palette Data Offset [2]	SV	22.2.3
88	Palette Data [2]	Buffered Bytes	22.2.3
89-89	*Reserved*		
8A	**Blit Report** [2]	CL	22.2.4
8B	Blit Rectangle X1 [2]	SV	22.2.4
8C	Blit Rectangle Y1 [2]	SV	22.2.4
8D	Blit Rectangle X2 [2]	SV	22.2.4
8E	Blit Rectangle Y2 [2]	SV	22.2.4
8F	Blit Data [2]	Buffered Bytes	22.2.4
90	**Soft Button** [2]	CL	22.2.1.5
91	Soft Button ID [2]	SV	22.2.1.5
92	Soft Button Side [2]	SV	22.2.1.5
93	Soft Button Offset 1 [2]	SV	22.2.1.5
94	Soft Button Offset 2 [2]	SV	22.2.1.5
95	Soft Button Report [2]	SV	22.2.5
96-C1	*Reserved*		
C2	Soft Keys [5]	SV	22.1.1
C3-CB	*Reserved*		
CC	Display Data Extensions [5]	SF	22.1.1

CD-CE	*Reserved*		
CF	Character Mapping [5]	SV	22.3
D0-DC	*Reserved*		
DD	Unicode Equivalent [5]	SV	22.3
DE-DE	*Reserved*		
DF	Character Page Mapping [5]	SV	22.3
E0-FE	*Reserved*		
FF	Request Report [5]	DV	22.4
100-FFFF	*Reserved*		

Table 22.1: Auxiliary Display Page

22.1 Alphanumeric Display

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

22.1.1 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 22.4. 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 **Character Report** 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 **Font Report** 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 22.5 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 22.6 for the bit-to-segment mapping.
Character Attribute	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 22.7 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	ˆ	n	
F			/	?	O	_	o	

Table 22.4: ASCII Display Character Set

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

Table 22.5: 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 22.6: 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 22.7: Display Data Extended Character Codes

22.1.2 Display Control

Usage Name	Usage Type	Description
Display Control Report	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 **Report** 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 **Report** descriptor, assume that the display does not support this feature.

22.1.3 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 ($Row \mathrel{!}= Rows$), 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.

22.1.4 Character Transfers

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

Usage Name	Usage Type	Description
Character Report	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 **Report Count** 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 **Report Size** 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 simultaneoulsy, 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.

22.1.5 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
Display Status	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.

22.1.6 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
Cursor Position Report	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. *Note: If pixel positioning is supported, the Row and Column fields must be large enough to contain either a character or pixel address.*
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 **Report** 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 **Report** 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 **Report** descriptor, assume that cursor blinking is off.

22.1.7 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
Font Report	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.

22.1.8 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.

22.1.8.1 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.

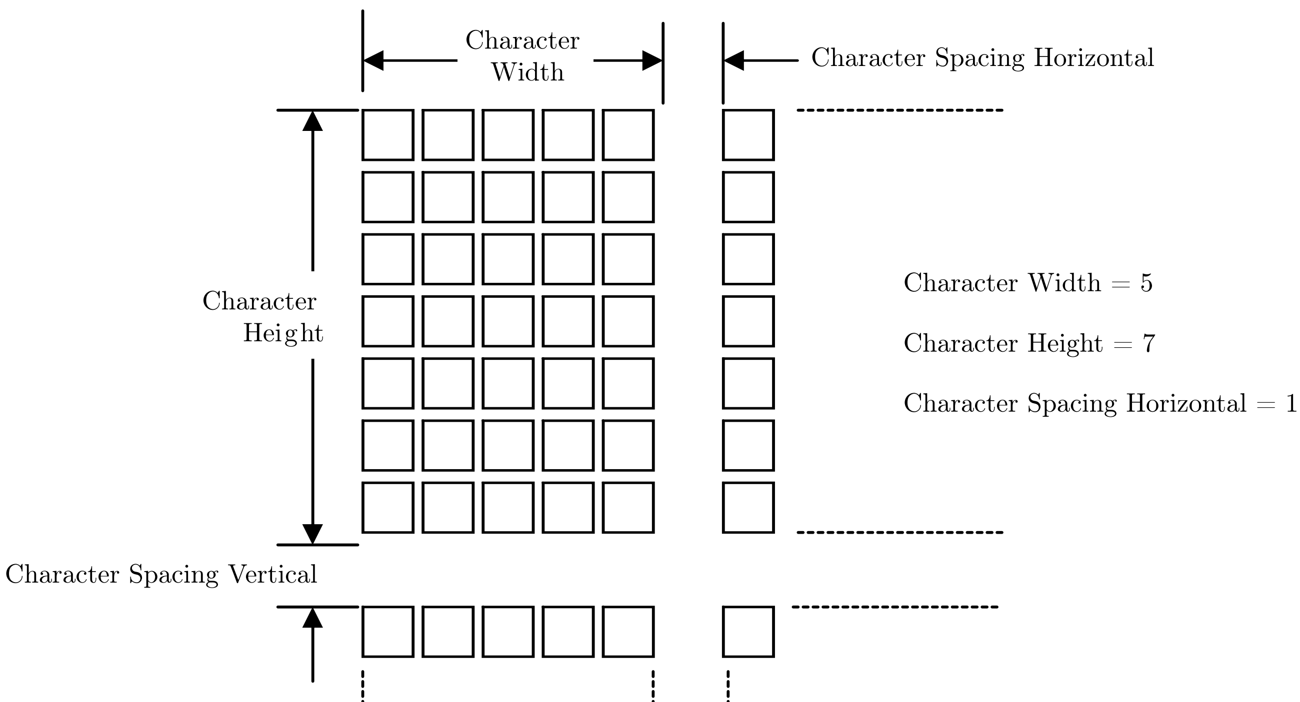


Figure 22.1: Matrix Character Segment Mapping

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

22.1.8.2 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.*

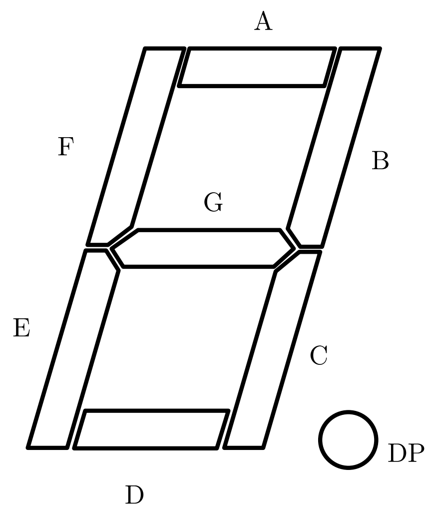


Figure 22.2: 7-Segment Character Segment Mapping

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 22.15: 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.*

22.1.8.3 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 22.1.8.3 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 22.16: 14-Segment Font Data

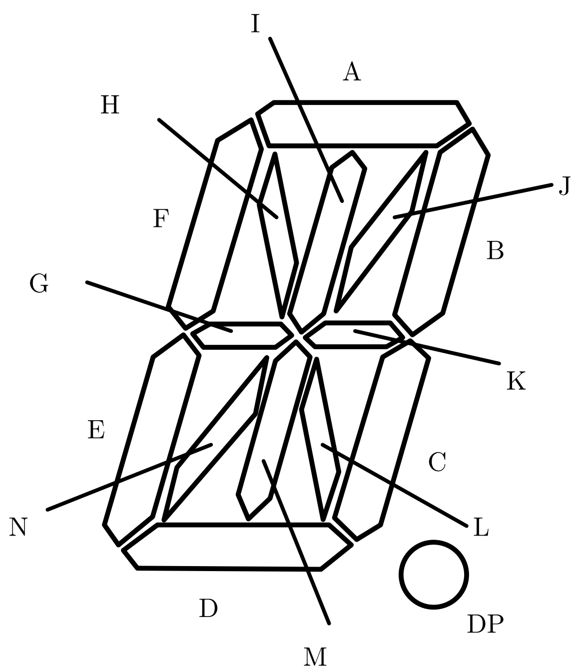


Figure 22.3: 14-Segment Character Segment Mapping

22.2 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.

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

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.

22.2.1 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.

22.2.1.1 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.

22.2.1.2 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.

22.2.1.3 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 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.

22.2.1.4 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.

22.2.1.5 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
Soft Button	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 *top* or *bottom* then the offset is in the column position of the side of the button nearest the origin. If the Soft Button Side usage equals *right* or *left* 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 *top* or *bottom* 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 *right* or *left* then the offset is in the row position of the side of the button farthest from the origin.

22.2.2 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.

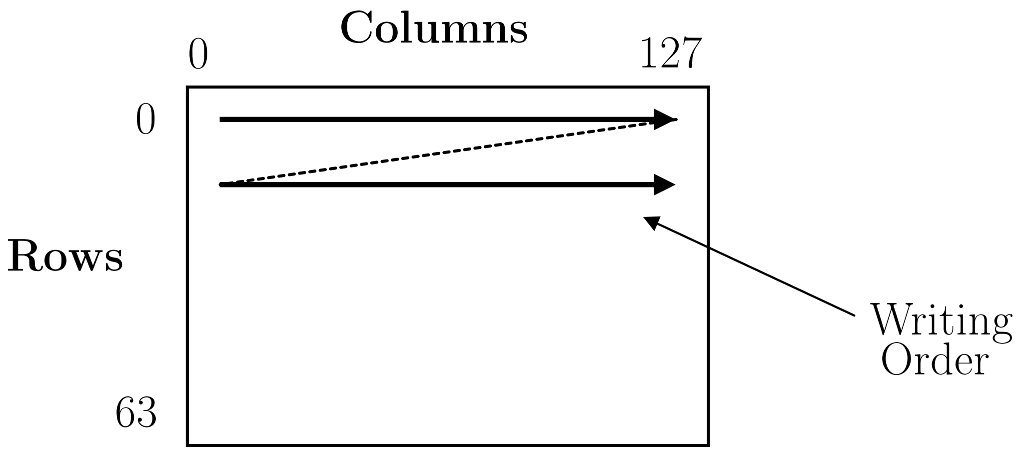


Figure 22.4: Display Orientation and Writing Order

Usage Name	Usage Type	Description
Display Orientation	DV	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. *Note: the application must perform the translations necessary to correctly display the screen to the user given the Orientation information.* • 0 - Origin at top left (default) • 1 - Origin at top right (rotated 90°clockwise) • 2 - Origin at bottom right (rotated 180°clockwise) • 3 - Origin at bottom left (rotated 270°clockwise)

22.2.3 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.

22.2.4 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
Blit Report	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 22.2.1.2 Bit Depth Format
Max Blit Size	SV	The maximum size of a blit (in bytes) that is supported by the display.[1]

22.2.5 Soft Button Report

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

[1] 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.

22.3 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 22.28: Page Mapping Definitions

22.4 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.

23 Sensors Page (0x20)

- 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	*Undefined*		
01	**Sensor** [12]	CA/CP	23.1
02-0F	*Reserved*		
10	**Biometric** [12]	CA/CP	23.1
11	**Biometric: Human Presence** [12]	CA/CP	23.1
12	**Biometric: Human Proximity** [12]	CA/CP	23.1
13	**Biometric: Human Touch** [12]	CA/CP	23.1
14	**Biometric: Blood Pressure** [30]	CA/CP	23.1
15	**Biometric: Body Temperature** [30]	CA/CP	23.1
16	**Biometric: Heart Rate** [30]	CA/CP	23.1
17	**Biometric: Heart Rate Variability** [30]	CA/CP	23.1
18	**Biometric: Peripheral Oxygen Saturation** [30]	CA/CP	23.1
19	**Biometric: Respiratory Rate** [30]	CA/CP	23.1
1A-1F	*Reserved*		
20	**Electrical** [12]	CA/CP	23.1
21	**Electrical: Capacitance** [12]	CA/CP	23.1
22	**Electrical: Current** [12]	CA/CP	23.1
23	**Electrical: Power** [12]	CA/CP	23.1
24	**Electrical: Inductance** [12]	CA/CP	23.1
25	**Electrical: Resistance** [12]	CA/CP	23.1
26	**Electrical: Voltage** [12]	CA/CP	23.1
27	**Electrical: Potentiometer** [12]	CA/CP	23.1
28	**Electrical: Frequency** [12]	CA/CP	23.1
29	**Electrical: Period** [12]	CA/CP	23.1
2A-2F	*Reserved*		
30	**Environmental** [12]	CA/CP	23.1

31	**Environmental: Atmospheric Pressure** [12]	CA/CP	23.1
32	**Environmental: Humidity** [12]	CA/CP	23.1
33	**Environmental: Temperature** [12]	CA/CP	23.1
34	**Environmental: Wind Direction** [12]	CA/CP	23.1
35	**Environmental: Wind Speed** [12]	CA/CP	23.1
36	**Environmental: Air Quality** [30]	CA/CP	23.1
37	**Environmental: Heat Index** [30]	CA/CP	23.1
38	**Environmental: Surface Temperature** [30]	CA/CP	23.1
39	**Environmental: Volatile Organic Compounds** [30]	CA/CP	23.1
3A	**Environmental: Object Presence** [50]	CA/CP	23.1
3B	**Environmental: Object Proximity** [50]	CA/CP	23.1
3C-3F	*Reserved*		
40	**Light** [12]	CA/CP	23.1
41	**Light: Ambient Light** [12]	CA/CP	23.1
42	**Light: Consumer Infrared** [12]	CA/CP	23.1
43	**Light: Infrared Light** [30]	CA/CP	23.1
44	**Light: Visible Light** [30]	CA/CP	23.1
45	**Light: Ultraviolet Light** [30]	CA/CP	23.1
46-4F	*Reserved*		
50	**Location** [12]	CA/CP	23.1
51	**Location: Broadcast** [12]	CA/CP	23.1
52	**Location: Dead Reckoning** [12]	CA/CP	23.1
53	**Location: GPS (Global Positioning System)** [12]	CA/CP	23.1
54	**Location: Lookup** [12]	CA/CP	23.1
55	**Location: Other** [12]	CA/CP	23.1
56	**Location: Static** [12]	CA/CP	23.1
57	**Location: Triangulation** [12]	CA/CP	23.1
58-5F	*Reserved*		
60	**Mechanical** [12]	CA/CP	23.1
61	**Mechanical: Boolean Switch** [12]	CA/CP	23.1
62	**Mechanical: Boolean Switch Array** [12]	CA/CP	23.1
63	**Mechanical: Multivalue Switch** [12]	CA/CP	23.1
64	**Mechanical: Force** [12]	CA/CP	23.1
65	**Mechanical: Pressure** [12]	CA/CP	23.1
66	**Mechanical: Strain** [12]	CA/CP	23.1
67	**Mechanical: Weight** [12]	CA/CP	23.1
68	**Mechanical: Haptic Vibrator** [12]	CA/CP	23.1
69	**Mechanical: Hall Effect Switch** [12]	CA/CP	23.1
6A-6F	*Reserved*		

70	**Motion** [12]	CA/CP	23.1
71	**Motion: Accelerometer 1D** [12]	CA/CP	23.1
72	**Motion: Accelerometer 2D** [12]	CA/CP	23.1
73	**Motion: Accelerometer 3D** [12]	CA/CP	23.1
74	**Motion: Gyrometer 1D** [12]	CA/CP	23.1
75	**Motion: Gyrometer 2D** [12]	CA/CP	23.1
76	**Motion: Gyrometer 3D** [12]	CA/CP	23.1
77	**Motion: Motion Detector** [12]	CA/CP	23.1
78	**Motion: Speedometer** [12]	CA/CP	23.1
79	**Motion: Accelerometer** [12]	CA/CP	23.1
7A	**Motion: Gyrometer** [12]	CA/CP	23.1
7B	**Motion: Gravity Vector** [30]	CA/CP	23.1
7C	**Motion: Linear Accelerometer** [30]	CA/CP	23.1
7D-7F	*Reserved*		
80	**Orientation** [12]	CA/CP	23.1
81	**Orientation: Compass 1D** [12]	CA/CP	23.1
82	**Orientation: Compass 2D** [12]	CA/CP	23.1
83	**Orientation: Compass 3D** [12]	CA/CP	23.1
84	**Orientation: Inclinometer 1D** [12]	CA/CP	23.1
85	**Orientation: Inclinometer 2D** [12]	CA/CP	23.1
86	**Orientation: Inclinometer 3D** [12]	CA/CP	23.1
87	**Orientation: Distance 1D** [12]	CA/CP	23.1
88	**Orientation: Distance 2D** [12]	CA/CP	23.1
89	**Orientation: Distance 3D** [12]	CA/CP	23.1
8A	**Orientation: Device Orientation** [12]	CA/CP	23.1
8B	**Orientation: Compass** [12]	CA/CP	23.1
8C	**Orientation: Inclinometer** [12]	CA/CP	23.1
8D	**Orientation: Distance** [12]	CA/CP	23.1
8E	**Orientation: Relative Orientation** [30]	CA/CP	23.1
8F	**Orientation: Simple Orientation** [30]	CA/CP	23.1
90	**Scanner** [12]	CA/CP	23.1
91	**Scanner: Barcode** [12]	CA/CP	23.1
92	**Scanner: RFID** [12]	CA/CP	23.1
93	**Scanner: NFC** [12]	CA/CP	23.1
94-9F	*Reserved*		
A0	**Time** [12]	CA/CP	23.1
A1	**Time: Alarm Timer** [12]	CA/CP	23.1
A2	**Time: Real Time Clock** [12]	CA/CP	23.1
A3-AF	*Reserved*		

`B0`	**Personal Activity** [30]	CA/CP	23.1
`B1`	**Personal Activity: Activity Detection** [30]	CA/CP	23.1
`B2`	**Personal Activity: Device Position** [30]	CA/CP	23.1
`B3`	**Personal Activity: Floor Tracker** [79]	CA/CP	23.1
`B4`	**Personal Activity: Pedometer** [79]	CA/CP	23.1
`B5`	**Personal Activity: Step Detection** [79]	CA/CP	23.1
`B6-BF`	*Reserved*		
`C0`	**Orientation Extended** [30]	CA/CP	23.1
`C1`	**Orientation Extended: Geomagnetic Orientation** [30]	CA/CP	23.1
`C2`	**Orientation Extended: Magnetometer** [30]	CA/CP	23.1
`C3-CF`	*Reserved*		
`D0`	**Gesture** [60]	CA/CP	23.1
`D1`	**Gesture: Chassis Flip Gesture** [60]	CA/CP	23.1
`D2`	**Gesture: Hinge Fold Gesture** [60]	CA/CP	23.1
`D3-DF`	*Reserved*		
`E0`	**Other** [12]	CA/CP	23.1
`E1`	**Other: Custom** [12]	CA/CP	23.1
`E2`	**Other: Generic** [12]	CA/CP	23.1
`E3`	**Other: Generic Enumerator** [12]	CA/CP	23.1
`E4`	**Other: Hinge Angle** [59]	CA/CP	23.1
`E5-EF`	*Reserved*		
`F0`	**Vendor Reserved 1** [12]	CA/CP	23.1
`F1`	**Vendor Reserved 2** [12]	CA/CP	23.1
`F2`	**Vendor Reserved 3** [12]	CA/CP	23.1
`F3`	**Vendor Reserved 4** [12]	CA/CP	23.1
`F4`	**Vendor Reserved 5** [12]	CA/CP	23.1
`F5`	**Vendor Reserved 6** [12]	CA/CP	23.1
`F6`	**Vendor Reserved 7** [12]	CA/CP	23.1
`F7`	**Vendor Reserved 8** [12]	CA/CP	23.1
`F8`	**Vendor Reserved 9** [12]	CA/CP	23.1
`F9`	**Vendor Reserved 10** [12]	CA/CP	23.1
`FA`	**Vendor Reserved 11** [12]	CA/CP	23.1
`FB`	**Vendor Reserved 12** [12]	CA/CP	23.1
`FC`	**Vendor Reserved 13** [12]	CA/CP	23.1
`FD`	**Vendor Reserved 14** [12]	CA/CP	23.1
`FE`	**Vendor Reserved 15** [12]	CA/CP	23.1
`FF`	**Vendor Reserved 16** [12]	CA/CP	23.1
`100-1FF`	*Reserved*		
`200`	Event [12]	DV	23.3

201	**Event: Sensor State** [12]	NAry	23.3
202	**Event: Sensor Event** [12]	NAry	23.4
203-2FF	*Reserved*		
300	Property [12]	DV	23.5
301	Property: Friendly Name [12]	SV	23.5
302	Property: Persistent Unique ID [12]	DV	23.5
303	Property: Sensor Status [12]	DV	23.5
304	Property: Minimum Report Interval [12]	SV	23.5
305	Property: Sensor Manufacturer [12]	SV	23.5
306	Property: Sensor Model [12]	SV	23.5
307	Property: Sensor Serial Number [12]	SV	23.5
308	Property: Sensor Description [12]	SV	23.5
309	**Property: Sensor Connection Type** [12]	NAry	23.5.1
30A	Property: Sensor Device Path [12]	DV	23.5
30B	Property: Hardware Revision [12]	SV	23.5
30C	Property: Firmware Version [12]	SV	23.5
30D	Property: Release Date [12]	SV	23.5
30E	Property: Report Interval [12]	DV	23.5
30F	Property: Change Sensitivity Absolute [12]	DV	23.5
310	Property: Change Sensitivity Percent of Range [12]	DV	23.5
311	Property: Change Sensitivity Percent Relative [12]	DV	23.5
312	Property: Accuracy [12]	DV	23.5
313	Property: Resolution [12]	DV	23.5
314	Property: Maximum [12]	DV	23.5
315	Property: Minimum [12]	DV	23.5
316	**Property: Reporting State** [12]	NAry	23.5.2
317	Property: Sampling Rate [12]	DV	23.5
318	Property: Response Curve [12]	DV	23.5
319	**Property: Power State** [12]	NAry	23.5.3
31A	Property: Maximum FIFO Events [27]	SV	23.5.4
31B	Property: Report Latency [27]	DV	23.5.4
31C	Property: Flush FIFO Events [30]	DF	23.5.4
31D	Property: Maximum Power Consumption [30]	DV	23.5.4
31E	Property: Is Primary [50]	DF	23.5
31F	**Property: Human Presence Detection Type** [69]	NAry	23.6
320-3FF	*Reserved*		
400	Data Field: Location [12]	DV	23.10
401-401	*Reserved*		
402	Data Field: Altitude Antenna Sea Level [12]	SV	23.10

403	Data Field: Differential Reference Station ID [12]	SV	23.10
404	Data Field: Altitude Ellipsoid Error [12]	SV	23.10
405	Data Field: Altitude Ellipsoid [12]	SV	23.10
406	Data Field: Altitude Sea Level Error [12]	SV	23.10
407	Data Field: Altitude Sea Level [12]	SV	23.10
408	Data Field: Differential GPS Data Age [12]	SV	23.10
409	Data Field: Error Radius [12]	SV	23.10
40A	**Data Field: Fix Quality** [12]	NAry	23.10.2
40B	**Data Field: Fix Type** [12]	NAry	23.10.3
40C	Data Field: Geoidal Separation [12]	SV	23.10
40D	**Data Field: GPS Operation Mode** [12]	NAry	23.10.4
40E	**Data Field: GPS Selection Mode** [12]	NAry	23.10.5
40F	**Data Field: GPS Status** [12]	NAry	23.10.6
410	Data Field: Position Dilution of Precision [12]	SV	23.10
411	Data Field: Horizontal Dilution of Precision [12]	SV	23.10
412	Data Field: Vertical Dilution of Precision [12]	SV	23.10
413	Data Field: Latitude [12]	SV	23.10
414	Data Field: Longitude [12]	SV	23.10
415	Data Field: True Heading [12]	SV	23.10
416	Data Field: Magnetic Heading [12]	SV	23.10
417	Data Field: Magnetic Variation [12]	SV	23.10
418	Data Field: Speed [12]	SV	23.10
419	Data Field: Satellites in View [12]	SV	23.10
41A	Data Field: Satellites in View Azimuth [12]	SV	23.10
41B	Data Field: Satellites in View Elevation [12]	SV	23.10
41C	Data Field: Satellites in View IDs [12]	SV	23.10
41D	Data Field: Satellites in View PRNs [12]	SV	23.10
41E	Data Field: Satellites in View S/N Ratios [12]	SV	23.10
41F	Data Field: Satellites Used Count [12]	SV	23.10
420	Data Field: Satellites Used PRNs [12]	SV	23.10
421	Data Field: NMEA Sentence [12]	SV	23.10
422	Data Field: Address Line 1 [12]	SV	23.10
423	Data Field: Address Line 2 [12]	SV	23.10
424	Data Field: City [12]	SV	23.10
425	Data Field: State or Province [12]	SV	23.10
426	Data Field: Country or Region [12]	SV	23.10
427	Data Field: Postal Code [12]	SV	23.10
428-429	*Reserved*		
42A	Property: Location [12]	DV	23.10

42B	**Property: Location Desired Accuracy** [12]	NAry	23.10.1
42C-42F	*Reserved*		
430	Data Field: Environmental [12]	SV	23.8
431	Data Field: Atmospheric Pressure [12]	SV	23.8
432-432	*Reserved*		
433	Data Field: Relative Humidity [12]	SV	23.8
434	Data Field: Temperature [12]	SV	23.8
435	Data Field: Wind Direction [12]	SV	23.8
436	Data Field: Wind Speed [12]	SV	23.8
437	Data Field: Air Quality Index [30]	SV	23.8
438	Data Field: Equivalent CO2 [30]	SV	23.8
439	Data Field: Volatile Organic Compound Concentration [30]	SV	23.8
43A	Data Field: Object Presence [50]	SF	23.8
43B	Data Field: Object Proximity Range [50]	SV	23.8
43C	Data Field: Object Proximity Out of Range [50]	SF	23.8
43D-43F	*Reserved*		
440	Property: Environmental [12]	SV	23.8
441	Property: Reference Pressure [12]	SV	23.8
442-44F	*Reserved*		
450	Data Field: Motion [12]	DV	23.12
451	Data Field: Motion State [12]	SF	23.12
452	Data Field: Acceleration [12]	SV	23.12
453	Data Field: Acceleration Axis X [12]	SV	23.12
454	Data Field: Acceleration Axis Y [12]	SV	23.12
455	Data Field: Acceleration Axis Z [12]	SV	23.12
456	Data Field: Angular Velocity [12]	SV	23.12
457	Data Field: Angular Velocity about X Axis [12]	SV	23.12
458	Data Field: Angular Velocity about Y Axis [12]	SV	23.12
459	Data Field: Angular Velocity about Z Axis [12]	SV	23.12
45A	Data Field: Angular Position [12]	SV	23.12
45B	Data Field: Angular Position about X Axis [12]	SV	23.12
45C	Data Field: Angular Position about Y Axis [12]	SV	23.12
45D	Data Field: Angular Position about Z Axis [12]	SV	23.12
45E	Data Field: Motion Speed [12]	SV	23.12
45F	Data Field: Motion Intensity [12]	SV	23.12
460-46F	*Reserved*		
470	Data Field: Orientation [12]	DV	23.13
471	Data Field: Heading [12]	SV	23.13
472	Data Field: Heading X Axis [12]	SV	23.13

473	Data Field: Heading Y Axis [12]	SV	23.13
474	Data Field: Heading Z Axis [12]	SV	23.13
475	Data Field: Heading Compensated Magnetic North [12]	SV	23.13
476	Data Field: Heading Compensated True North [12]	SV	23.13
477	Data Field: Heading Magnetic North [12]	SV	23.13
478	Data Field: Heading True North [12]	SV	23.13
479	Data Field: Distance [12]	SV	23.13
47A	Data Field: Distance X Axis [12]	SV	23.13
47B	Data Field: Distance Y Axis [12]	SV	23.13
47C	Data Field: Distance Z Axis [12]	SV	23.13
47D	Data Field: Distance Out-of-Range [12]	SF	23.13
47E	Data Field: Tilt [12]	SV	23.13
47F	Data Field: Tilt X Axis [12]	SV	23.13
480	Data Field: Tilt Y Axis [12]	SV	23.13
481	Data Field: Tilt Z Axis [12]	SV	23.13
482	Data Field: Rotation Matrix [12]	SV	23.13
483	Data Field: Quaternion [12]	SV	23.13
484	Data Field: Magnetic Flux [12]	SV	23.13
485	Data Field: Magnetic Flux X Axis [12]	SV	23.13
486	Data Field: Magnetic Flux Y Axis [12]	SV	23.13
487	Data Field: Magnetic Flux Z Axis [12]	SV	23.13
488	**Data Field: Magnetometer Accuracy** [12]	NAry	23.13.1
489	**Data Field: Simple Orientation Direction** [30]	NAry	23.13.2
48A-48F	*Reserved*		
490	Data Field: Mechanical [12]	DV	23.11
491	Data Field: Boolean Switch State [12]	SF	23.11
492	Data Field: Boolean Switch Array States [12]	SV	23.11
493	Data Field: Multivalue Switch Value [12]	SV	23.11
494	Data Field: Force [12]	SV	23.11
495	Data Field: Absolute Pressure [12]	SV	23.11
496	Data Field: Gauge Pressure [12]	SV	23.11
497	Data Field: Strain [12]	SV	23.11
498	Data Field: Weight [12]	SV	23.11
499-49F	*Reserved*		
4A0	Property: Mechanical [12]	DV	23.11
4A1	Property: Vibration State [12]	DF	23.11
4A2	Property: Forward Vibration Speed [12]	DV	23.11
4A3	Property: Backward Vibration Speed [12]	DV	23.11
4A4-4AF	*Reserved*		

4B0	Data Field: Biometric [12]	DV	23.6
4B1	Data Field: Human Presence [12]	SF	23.6
4B2	Data Field: Human Proximity Range [12]	SV	23.6
4B3	Data Field: Human Proximity Out of Range [12]	SF	23.6
4B4	Data Field: Human Touch State [12]	SF	23.6
4B5	Data Field: Blood Pressure [12]	SV	23.6
4B6	Data Field: Blood Pressure Diastolic [30]	SV	23.6
4B7	Data Field: Blood Pressure Systolic [30]	SV	23.6
4B8	Data Field: Heart Rate [30]	SV	23.6
4B9	Data Field: Resting Heart Rate [30]	SV	23.6
4BA	Data Field: Heartbeat Interval [30]	SV	23.6
4BB	Data Field: Respiratory Rate [30]	SV	23.6
4BC	Data Field: SpO2 [30]	SV	23.6
4BD	Data Field: Human Attention Detected [74]	MC	23.6
4BE	Data Field: Human Head Azimuth [80]	SV	23.6.1
4BF	Data Field: Human Head Altitude [80]	SV	23.6.1
4C0	Data Field: Human Head Roll [80]	SV	23.6.1
4C1	Data Field: Human Head Pitch [80]	SV	23.6.1
4C2	Data Field: Human Head Yaw [80]	SV	23.6.1
4C3	Data Field: Human Correlation Id [80]	SV	23.6.1
4C4-4CF	*Reserved*		
4D0	Data Field: Light [12]	DV	23.9
4D1	Data Field: Illuminance [12]	SV	23.9
4D2	Data Field: Color Temperature [12]	SV	23.9
4D3	Data Field: Chromaticity [12]	SV	23.9
4D4	Data Field: Chromaticity X [12]	SV	23.9
4D5	Data Field: Chromaticity Y [12]	SV	23.9
4D6	Data Field: Consumer IR Sentence Receive [12]	SV	23.9
4D7	Data Field: Infrared Light [30]	SV	23.9
4D8	Data Field: Red Light [30]	SV	23.9
4D9	Data Field: Green Light [30]	SV	23.9
4DA	Data Field: Blue Light [30]	SV	23.9
4DB	Data Field: Ultraviolet A Light [30]	SV	23.9
4DC	Data Field: Ultraviolet B Light [30]	SV	23.9
4DD	Data Field: Ultraviolet Index [30]	SV	23.9
4DE	Data Field: Near Infrared Light [50]	SV	23.9
4DF	Property: Light [12]	DV	23.9
4E0	Property: Consumer IR Sentence Send [12]	DV	23.9
4E1-4E1	*Reserved*		

4E2	Property: Auto Brightness Preferred [50]	DF	23.9
4E3	Property: Auto Color Preferred [50]	DF	23.9
4E4-4EF	*Reserved*		
4F0	Data Field: Scanner [12]	DV	23.14
4F1	Data Field: RFID Tag 40 Bit [12]	SV	23.14
4F2	Data Field: NFC Sentence Receive [12]	SV	23.14
4F3-4F7	*Reserved*		
4F8	Property: Scanner [12]	DV	23.14
4F9	Property: NFC Sentence Send [12]	SV	23.14
4FA-4FF	*Reserved*		
500	Data Field: Electrical [12]	SV	23.7
501	Data Field: Capacitance [12]	SV	23.7
502	Data Field: Current [12]	SV	23.7
503	Data Field: Electrical Power [12]	SV	23.7
504	Data Field: Inductance [12]	SV	23.7
505	Data Field: Resistance [12]	SV	23.7
506	Data Field: Voltage [12]	SV	23.7
507	Data Field: Frequency [12]	SV	23.7
508	Data Field: Period [12]	SV	23.7
509	Data Field: Percent of Range [12]	SV	23.7
50A-51F	*Reserved*		
520	Data Field: Time [12]	DV	23.15
521	Data Field: Year [12]	SV	23.15
522	Data Field: Month [12]	SV	23.15
523	Data Field: Day [12]	SV	23.15
524	**Data Field: Day of Week** [12]	NAry	23.15.1
525	Data Field: Hour [12]	SV	23.15
526	Data Field: Minute [12]	SV	23.15
527	Data Field: Second [12]	SV	23.15
528	Data Field: Millisecond [12]	SV	23.15
529	Data Field: Timestamp [12]	SV	23.15
52A	Data Field: Julian Day of Year [12]	SV	23.15
52B	Data Field: Time Since System Boot [30]	SV	23.15
52C-52F	*Reserved*		
530	Property: Time [12]	DV	23.15
531	Property: Time Zone Offset from UTC [12]	DV	23.15
532	Property: Time Zone Name [12]	DV	23.15
533	Property: Daylight Savings Time Observed [12]	DF	23.15
534	Property: Time Trim Adjustment [12]	DV	23.15

535	Property: Arm Alarm [12]	DF	23.15
536-53F	*Reserved*		
540	Data Field: Custom [12]	DV	23.16
541	Data Field: Custom Usage [12]	SV	23.16
542	Data Field: Custom Boolean Array [12]	SV	23.16
543	Data Field: Custom Value [12]	SV	23.16
544	Data Field: Custom Value 1 [12]	SV	23.16
545	Data Field: Custom Value 2 [12]	SV	23.16
546	Data Field: Custom Value 3 [12]	SV	23.16
547	Data Field: Custom Value 4 [12]	SV	23.16
548	Data Field: Custom Value 5 [12]	SV	23.16
549	Data Field: Custom Value 6 [12]	SV	23.16
54A	Data Field: Custom Value 7 [30]	SV	23.16
54B	Data Field: Custom Value 8 [30]	SV	23.16
54C	Data Field: Custom Value 9 [30]	SV	23.16
54D	Data Field: Custom Value 10 [30]	SV	23.16
54E	Data Field: Custom Value 11 [30]	SV	23.16
54F	Data Field: Custom Value 12 [30]	SV	23.16
550	Data Field: Custom Value 13 [30]	SV	23.16
551	Data Field: Custom Value 14 [30]	SV	23.16
552	Data Field: Custom Value 15 [30]	SV	23.16
553	Data Field: Custom Value 16 [30]	SV	23.16
554	Data Field: Custom Value 17 [30]	SV	23.16
555	Data Field: Custom Value 18 [30]	SV	23.16
556	Data Field: Custom Value 19 [30]	SV	23.16
557	Data Field: Custom Value 20 [30]	SV	23.16
558	Data Field: Custom Value 21 [30]	SV	23.16
559	Data Field: Custom Value 22 [30]	SV	23.16
55A	Data Field: Custom Value 23 [30]	SV	23.16
55B	Data Field: Custom Value 24 [30]	SV	23.16
55C	Data Field: Custom Value 25 [30]	SV	23.16
55D	Data Field: Custom Value 26 [30]	SV	23.16
55E	Data Field: Custom Value 27 [30]	SV	23.16
55F	Data Field: Custom Value 28 [30]	SV	23.16
560	Data Field: Generic [12]	DV	23.18
561	Data Field: Generic GUID or PROPERTYKEY [12]	SV	23.18
562	Data Field: Generic Category GUID [12]	SV	23.18
563	Data Field: Generic Type GUID [12]	SV	23.18
564	Data Field: Generic Event PROPERTYKEY [12]	SV	23.18

565	Data Field: Generic Property PROPERTYKEY [12]	SV	23.18
566	Data Field: Generic Data Field PROPERTYKEY [12]	SV	23.18
567	Data Field: Generic Event [12]	SV	23.18
568	Data Field: Generic Property [12]	SV	23.18
569	Data Field: Generic Data Field [12]	SV	23.18
56A	Data Field: Enumerator Table Row Index [12]	SV	23.18
56B	Data Field: Enumerator Table Row Count [12]	SV	23.18
56C	**Data Field: Generic GUID or PROPERTYKEY kind** [12]	NAry	23.18.1
56D	Data Field: Generic GUID [12]	SV	23.18
56E	Data Field: Generic PROPERTYKEY [12]	SV	23.18
56F	Data Field: Generic Top Level Collection ID [12]	SV	23.18
570	Data Field: Generic Report ID [12]	SV	23.18
571	Data Field: Generic Report Item Position Index [12]	SV	23.18
572	**Data Field: Generic Firmware VARTYPE** [12]	NAry	23.18.2
573	**Data Field: Generic Unit of Measure** [12]	NAry	23.18.3
574	**Data Field: Generic Unit Exponent** [12]	NAry	23.18.4
575	Data Field: Generic Report Size [12]	SV	23.18
576	Data Field: Generic Report Count [12]	SV	23.18
577-57F	*Reserved*		
580	Property: Generic [12]	DV	23.18
581	Property: Enumerator Table Row Index [12]	DV	23.18
582	Property: Enumerator Table Row Count [12]	SV	23.18
583-58F	*Reserved*		
590	Data Field: Personal Activity [30]	DV	23.19
591	**Data Field: Activity Type** [30]	NAry	23.19.1
592	**Data Field: Activity State** [30]	NAry	23.19.2
593	**Data Field: Device Position** [30]	NAry	23.19.3
594	Data Field: Step Count [30]	SV	23.19
595	Data Field: Step Count Reset [30]	DF	23.19
596	Data Field: Step Duration [30]	SV	23.19
597	**Data Field: Step Type** [30]	NAry	23.19.4
598-59F	*Reserved*		
5A0	Property: Minimum Activity Detection Interval [30]	DV	23.19
5A1	**Property: Supported Activity Types** [30]	NAry	23.19
5A2	**Property: Subscribed Activity Types** [30]	NAry	23.19
5A3	**Property: Supported Step Types** [30]	NAry	23.19
5A4	**Property: Subscribed Step Types** [30]	NAry	23.19
5A5	Property: Floor Height [30]	DV	23.19
5A6-5AF	*Reserved*		

5B0	Data Field: Custom Type ID [30]	SV	23.16
5B1-5BF	*Reserved*		
5C0	Property: Custom [50]	DV	23.17
5C1	Property: Custom Value 1 [50]	DV	23.17
5C2	Property: Custom Value 2 [50]	DV	23.17
5C3	Property: Custom Value 3 [50]	DV	23.17
5C4	Property: Custom Value 4 [50]	DV	23.17
5C5	Property: Custom Value 5 [50]	DV	23.17
5C6	Property: Custom Value 6 [50]	DV	23.17
5C7	Property: Custom Value 7 [50]	DV	23.17
5C8	Property: Custom Value 8 [50]	DV	23.17
5C9	Property: Custom Value 9 [50]	DV	23.17
5CA	Property: Custom Value 10 [50]	DV	23.17
5CB	Property: Custom Value 11 [50]	DV	23.17
5CC	Property: Custom Value 12 [50]	DV	23.17
5CD	Property: Custom Value 13 [50]	DV	23.17
5CE	Property: Custom Value 14 [50]	DV	23.17
5CF	Property: Custom Value 15 [50]	DV	23.17
5D0	Property: Custom Value 16 [50]	DV	23.17
5D1-5DF	*Reserved*		
5E0	Data Field: Hinge [59]	SV/DV	23.20.1
5E1	Data Field: Hinge Angle [59]	SV/DV	23.20.1
5E2-5EF	*Reserved*		
5F0	Data Field: Gesture Sensor [60]	DV	23.20.2.3
5F1	**Data Field: Gesture State** [60]	NAry	23.20.2.4
5F2	Data Field: Hinge Fold Initial Angle [60]	SV	23.20.2.3
5F3	Data Field: Hinge Fold Final Angle [60]	SV	23.20.2.3
5F4	**Data Field: Hinge Fold Contributing Panel** [60]	NAry	23.20.2.5
5F5	**Data Field: Hinge Fold Type** [60]	NAry	23.20.2.6
5F6-7FF	*Reserved*		
800	Sensor State: Undefined [12]	Sel	23.3
801	Sensor State: Ready [12]	Sel	23.3
802	Sensor State: Not Available [12]	Sel	23.3
803	Sensor State: No Data [12]	Sel	23.3
804	Sensor State: Initializing [12]	Sel	23.3
805	Sensor State: Access Denied [12]	Sel	23.3
806	Sensor State: Error [12]	Sel	23.3
807-80F	*Reserved*		
810	Sensor Event: Unknown [12]	Sel	23.4

811	Sensor Event: State Changed [12]	Sel	23.4
812	Sensor Event: Property Changed [12]	Sel	23.4
813	Sensor Event: Data Updated [12]	Sel	23.4
814	Sensor Event: Poll Response [12]	Sel	23.4
815	Sensor Event: Change Sensitivity [12]	Sel	23.4
816	Sensor Event: Range Maximum Reached [12]	Sel	23.4
817	Sensor Event: Range Minimum Reached [12]	Sel	23.4
818	Sensor Event: High Threshold Cross Upward [12]	Sel	23.4
819	Sensor Event: High Threshold Cross Downward [12]	Sel	23.4
81A	Sensor Event: Low Threshold Cross Upward [12]	Sel	23.4
81B	Sensor Event: Low Threshold Cross Downward [12]	Sel	23.4
81C	Sensor Event: Zero Threshold Cross Upward [12]	Sel	23.4
81D	Sensor Event: Zero Threshold Cross Downward [12]	Sel	23.4
81E	Sensor Event: Period Exceeded [12]	Sel	23.4
81F	Sensor Event: Frequency Exceeded [12]	Sel	23.4
820	Sensor Event: Complex Trigger [12]	Sel	23.4
821-82F	*Reserved*		
830	Connection Type: PC Integrated [12]	Sel	23.5.1
831	Connection Type: PC Attached [12]	Sel	23.5.1
832	Connection Type: PC External [12]	Sel	23.5.1
833-83F	*Reserved*		
840	Reporting State: Report No Events [12]	Sel	23.5.2
841	Reporting State: Report All Events [12]	Sel	23.5.2
842	Reporting State: Report Threshold Events [12]	Sel	23.5.2
843	Reporting State: Wake On No Events [12]	Sel	23.5.2
844	Reporting State: Wake On All Events [12]	Sel	23.5.2
845	Reporting State: Wake On Threshold Events [12]	Sel	23.5.2
846	Reporting State: Anytime [79]	Sel	23.5.2
847-84F	*Reserved*		
850	Power State: Undefined [12]	Sel	23.5.3
851	Power State: D0 Full Power [12]	Sel	23.5.3
852	Power State: D1 Low Power [12]	Sel	23.5.3
853	Power State: D2 Standby Power with Wakeup [12]	Sel	23.5.3
854	Power State: D3 Sleep with Wakeup [12]	Sel	23.5.3
855	Power State: D4 Power Off [12]	Sel	23.5.3
856-85F	*Reserved*		
860	Accuracy: Default [12]	Sel	23.10.1
861	Accuracy: High [12]	Sel	23.10.1
862	Accuracy: Medium [12]	Sel	23.10.1

863	Accuracy: Low [12]	Sel	23.10.1
864-86F	*Reserved*		
870	Fix Quality: No Fix [12]	Sel	23.10.2
871	Fix Quality: GPS [12]	Sel	23.10.2
872	Fix Quality: DGPS [12]	Sel	23.10.2
873-87F	*Reserved*		
880	Fix Type: No Fix [12]	Sel	23.10.3
881	Fix Type: GPS SPS Mode, Fix Valid [12]	Sel	23.10.3
882	Fix Type: DGPS SPS Mode, Fix Valid [12]	Sel	23.10.3
883	Fix Type: GPS PPS Mode, Fix Valid [12]	Sel	23.10.3
884	Fix Type: Real Time Kinematic [12]	Sel	23.10.3
885	Fix Type: Float RTK [12]	Sel	23.10.3
886	Fix Type: Estimated (dead reckoned) [12]	Sel	23.10.3
887	Fix Type: Manual Input Mode [12]	Sel	23.10.3
888	Fix Type: Simulator Mode [12]	Sel	23.10.3
889-88F	*Reserved*		
890	GPS Operation Mode: Manual [12]	Sel	23.10.4
891	GPS Operation Mode: Automatic [12]	Sel	23.10.4
892-89F	*Reserved*		
8A0	GPS Selection Mode: Autonomous [12]	Sel	23.10.5
8A1	GPS Selection Mode: DGPS [12]	Sel	23.10.5
8A2	GPS Selection Mode: Estimated (dead reckoned) [12]	Sel	23.10.5
8A3	GPS Selection Mode: Manual Input [12]	Sel	23.10.5
8A4	GPS Selection Mode: Simulator [12]	Sel	23.10.5
8A5	GPS Selection Mode: Data Not Valid [12]	Sel	23.10.5
8A6-8AF	*Reserved*		
8B0	GPS Status Data: Valid [12]	Sel	23.10.6
8B1	GPS Status Data: Not Valid [12]	Sel	23.10.6
8B2-8BF	*Reserved*		
8C0	Day of Week: Sunday [12]	Sel	23.15.1
8C1	Day of Week: Monday [12]	Sel	23.15.1
8C2	Day of Week: Tuesday [12]	Sel	23.15.1
8C3	Day of Week: Wednesday [12]	Sel	23.15.1
8C4	Day of Week: Thursday [12]	Sel	23.15.1
8C5	Day of Week: Friday [12]	Sel	23.15.1
8C6	Day of Week: Saturday [12]	Sel	23.15.1
8C7-8CF	*Reserved*		
8D0	Kind: Category [12]	Sel	23.18.1
8D1	Kind: Type [12]	Sel	23.18.1
8D2	Kind: Event [12]	Sel	23.18.1

8D3	Kind: Property [12]	Sel	23.18.1
8D4	Kind: Data Field [12]	Sel	23.18.1
8D5-8DF	*Reserved*		
8E0	Magnetometer Accuracy: Low [12]	Sel	23.13.1
8E1	Magnetometer Accuracy: Medium [12]	Sel	23.13.1
8E2	Magnetometer Accuracy: High [12]	Sel	23.13.1
8E3-8EF	*Reserved*		
8F0	Simple Orientation Direction: Not Rotated [30]	Sel	23.13.2
8F1	Simple Orientation Direction: Rotated 90 Degrees CCW [30]	Sel	23.13.2
8F2	Simple Orientation Direction: Rotated 180 Degrees CCW [30]	Sel	23.13.2
8F3	Simple Orientation Direction: Rotated 270 Degrees CCW [30]	Sel	23.13.2
8F4	Simple Orientation Direction: Face Up [30]	Sel	23.13.2
8F5	Simple Orientation Direction: Face Down [30]	Sel	23.13.2
8F6-8FF	*Reserved*		
900	VT_NULL [12]	Sel	23.18.2
901	VT_BOOL [12]	Sel	23.18.2
902	VT_UI1 [12]	Sel	23.18.2
903	VT_I1 [12]	Sel	23.18.2
904	VT_UI2 [12]	Sel	23.18.2
905	VT_I2 [12]	Sel	23.18.2
906	VT_UI4 [12]	Sel	23.18.2
907	VT_I4 [12]	Sel	23.18.2
908	VT_UI8 [12]	Sel	23.18.2
909	VT_I8 [12]	Sel	23.18.2
90A	VT_R4 [12]	Sel	23.18.2
90B	VT_R8 [12]	Sel	23.18.2
90C	VT_WSTR [12]	Sel	23.18.2
90D	VT_STR [12]	Sel	23.18.2
90E	VT_CLSID [12]	Sel	23.18.2
90F	VT_VECTOR VT_UI1 [12]	Sel	23.18.2
910	VT_F16E0 [12]	Sel	23.18.2
911	VT_F16E1 [12]	Sel	23.18.2
912	VT_F16E2 [12]	Sel	23.18.2
913	VT_F16E3 [12]	Sel	23.18.2
914	VT_F16E4 [12]	Sel	23.18.2
915	VT_F16E5 [12]	Sel	23.18.2
916	VT_F16E6 [12]	Sel	23.18.2
917	VT_F16E7 [12]	Sel	23.18.2
918	VT_F16E8 [12]	Sel	23.18.2

919	VT_F16E9 [12]	Sel	23.18.2
91A	VT_F16EA [12]	Sel	23.18.2
91B	VT_F16EB [12]	Sel	23.18.2
91C	VT_F16EC [12]	Sel	23.18.2
91D	VT_F16ED [12]	Sel	23.18.2
91E	VT_F16EE [12]	Sel	23.18.2
91F	VT_F16EF [12]	Sel	23.18.2
920	VT_F32E0 [12]	Sel	23.18.2
921	VT_F32E1 [12]	Sel	23.18.2
922	VT_F32E2 [12]	Sel	23.18.2
923	VT_F32E3 [12]	Sel	23.18.2
924	VT_F32E4 [12]	Sel	23.18.2
925	VT_F32E5 [12]	Sel	23.18.2
926	VT_F32E6 [12]	Sel	23.18.2
927	VT_F32E7 [12]	Sel	23.18.2
928	VT_F32E8 [12]	Sel	23.18.2
929	VT_F32E9 [12]	Sel	23.18.2
92A	VT_F32EA [12]	Sel	23.18.2
92B	VT_F32EB [12]	Sel	23.18.2
92C	VT_F32EC [12]	Sel	23.18.2
92D	VT_F32ED [12]	Sel	23.18.2
92E	VT_F32EE [12]	Sel	23.18.2
92F	VT_F32EF [12]	Sel	23.18.2
930	Activity Type: Unknown [30]	Sel	23.19.1
931	Activity Type: Stationary [30]	Sel	23.19.1
932	Activity Type: Fidgeting [30]	Sel	23.19.1
933	Activity Type: Walking [30]	Sel	23.19.1
934	Activity Type: Running [30]	Sel	23.19.1
935	Activity Type: In Vehicle [30]	Sel	23.19.1
936	Activity Type: Biking [30]	Sel	23.19.1
937	Activity Type: Idle [30]	Sel	23.19.1
938-93F	*Reserved*		
940	Unit: Not Specified [12]	Sel	23.18.3
941	Unit: Lux [12]	Sel	23.18.3
942	Unit: Degrees Kelvin [12]	Sel	23.18.3
943	Unit: Degrees Celsius [12]	Sel	23.18.3
944	Unit: Pascal [12]	Sel	23.18.3
945	Unit: Newton [12]	Sel	23.18.3
946	Unit: Meters/Second [12]	Sel	23.18.3

947	Unit: Kilogram [12]	Sel	23.18.3
948	Unit: Meter [12]	Sel	23.18.3
949	Unit: Meters/Second/Second [12]	Sel	23.18.3
94A	Unit: Farad [12]	Sel	23.18.3
94B	Unit: Ampere [12]	Sel	23.18.3
94C	Unit: Watt [12]	Sel	23.18.3
94D	Unit: Henry [12]	Sel	23.18.3
94E	Unit: Ohm [12]	Sel	23.18.3
94F	Unit: Volt [12]	Sel	23.18.3
950	Unit: Hertz [12]	Sel	23.18.3
951	Unit: Bar [12]	Sel	23.18.3
952	Unit: Degrees Anti-clockwise [12]	Sel	23.18.3
953	Unit: Degrees Clockwise [12]	Sel	23.18.3
954	Unit: Degrees [12]	Sel	23.18.3
955	Unit: Degrees/Second [12]	Sel	23.18.3
956	Unit: Degrees/Second/Second [12]	Sel	23.18.3
957	Unit: Knot [12]	Sel	23.18.3
958	Unit: Percent [12]	Sel	23.18.3
959	Unit: Second [12]	Sel	23.18.3
95A	Unit: Millisecond [12]	Sel	23.18.3
95B	Unit: G [12]	Sel	23.18.3
95C	Unit: Bytes [12]	Sel	23.18.3
95D	Unit: Milligauss [12]	Sel	23.18.3
95E	Unit: Bits [12]	Sel	23.18.3
95F-95F	*Reserved*		
960	Activity State: No State Change [30]	Sel	23.19.2
961	Activity State: Start Activity [30]	Sel	23.19.2
962	Activity State: End Activity [30]	Sel	23.19.2
963-96F	*Reserved*		
970	Exponent 0 [12]	Sel	23.18.4
971	Exponent 1 [12]	Sel	23.18.4
972	Exponent 2 [12]	Sel	23.18.4
973	Exponent 3 [12]	Sel	23.18.4
974	Exponent 4 [12]	Sel	23.18.4
975	Exponent 5 [12]	Sel	23.18.4
976	Exponent 6 [12]	Sel	23.18.4
977	Exponent 7 [12]	Sel	23.18.4
978	Exponent 8 [12]	Sel	23.18.4
979	Exponent 9 [12]	Sel	23.18.4

97A	Exponent A [12]	Sel	23.18.4
97B	Exponent B [12]	Sel	23.18.4
97C	Exponent C [12]	Sel	23.18.4
97D	Exponent D [12]	Sel	23.18.4
97E	Exponent E [12]	Sel	23.18.4
97F	Exponent F [12]	Sel	23.18.4
980	Device Position: Unknown [30]	Sel	23.19.3
981	Device Position: Unchanged [30]	Sel	23.19.3
982	Device Position: On Desk [30]	Sel	23.19.3
983	Device Position: In Hand [30]	Sel	23.19.3
984	Device Position: Moving in Bag [30]	Sel	23.19.3
985	Device Position: Stationary in Bag [30]	Sel	23.19.3
986-98F	*Reserved*		
990	Step Type: Unknown [30]	Sel	23.19.4
991	Step Type: Walking [79]	Sel	23.19.4
992	Step Type: Running [79]	Sel	23.19.4
993-99F	*Reserved*		
9A0	Gesture State: Unknown [60]	Sel	23.20.2.4
9A1	Gesture State: Started [60]	Sel	23.20.2.4
9A2	Gesture State: Completed [60]	Sel	23.20.2.4
9A3	Gesture State: Cancelled [60]	Sel	23.20.2.4
9A4-9AF	*Reserved*		
9B0	Hinge Fold Contributing Panel: Unknown [60]	Sel	23.20.2.5
9B1	Hinge Fold Contributing Panel: Panel 1 [60]	Sel	23.20.2.5
9B2	Hinge Fold Contributing Panel: Panel 2 [60]	Sel	23.20.2.5
9B3	Hinge Fold Contributing Panel: Both [60]	Sel	23.20.2.5
9B4	Hinge Fold Type: Unknown [60]	Sel	23.20.2.6
9B5	Hinge Fold Type: Increasing [60]	Sel	23.20.2.6
9B6	Hinge Fold Type: Decreasing [60]	Sel	23.20.2.6
9B7-9BF	*Reserved*		
9C0	Human Presence Detection Type: Vendor-Defined Non-Biometric [69]	Sel	23.6
9C1	Human Presence Detection Type: Vendor-Defined Biometric [69]	Sel	23.6
9C2	Human Presence Detection Type: Facial Biometric [69]	Sel	23.6
9C3	Human Presence Detection Type: Audio Biometric [69]	Sel	23.6
9C4-FFF	*Reserved*		
1000	Modifier: Change Sensitivity Absolute [12]	US	23.2
1001-10FF	*Reserved*		
1100-17FF	*Reserved for use as Change Sensitivity Absolute modifier range*		
1800-1FFF	*Reserved*		
2000	Modifier: Maximum [12]	US	23.2

2001-20FF	*Reserved*		
2100-27FF	*Reserved for use as Maximum modifier range*		
2800-2FFF	*Reserved*		
3000	Modifier: Minimum [12]	US	23.2
3001-30FF	*Reserved*		
3100-37FF	*Reserved for use as Minimum modifier range*		
3800-3FFF	*Reserved*		
4000	Modifier: Accuracy [12]	US	23.2
4001-40FF	*Reserved*		
4100-47FF	*Reserved for use as Accuracy modifier range*		
4800-4FFF	*Reserved*		
5000	Modifier: Resolution [12]	US	23.2
5001-50FF	*Reserved*		
5100-57FF	*Reserved for use as Resolution modifier range*		
5800-5FFF	*Reserved*		
6000	Modifier: Threshold High [12]	US	23.2
6001-60FF	*Reserved*		
6100-67FF	*Reserved for use as Threshold High modifier range*		
6800-6FFF	*Reserved*		
7000	Modifier: Threshold Low [12]	US	23.2
7001-70FF	*Reserved*		
7100-77FF	*Reserved for use as Threshold Low modifier range*		
7800-7FFF	*Reserved*		
8000	Modifier: Calibration Offset [12]	US	23.2
8001-80FF	*Reserved*		
8100-87FF	*Reserved for use as Calibration Offset modifier range*		
8800-8FFF	*Reserved*		
9000	Modifier: Calibration Multiplier [12]	US	23.2
9001-90FF	*Reserved*		
9100-97FF	*Reserved for use as Calibration Multiplier modifier range*		
9800-9FFF	*Reserved*		
A000	Modifier: Report Interval [12]	US	23.2
A001-A0FF	*Reserved*		
A100-A7FF	*Reserved for use as Report Interval modifier range*		
A800-AFFF	*Reserved*		
B000	Modifier: Frequency Max [12]	US	23.2
B001-B0FF	*Reserved*		
B100-B7FF	*Reserved for use as Frequency Max modifier range*		
B800-BFFF	*Reserved*		
C000	Modifier: Period Max [12]	US	23.2
C001-C0FF	*Reserved*		
C100-C7FF	*Reserved for use as Period Max modifier range*		
C800-CFFF	*Reserved*		

D000	Modifier: Change Sensitivity Percent of Range [12]	US	23.2
D001-D0FF	*Reserved*		
D100-D7FF	*Reserved for use as Change Sensitivity Percent modifier range*		
D800-DFFF	*Reserved*		
E000	Modifier: Change Sensitivity Percent Relative [12]	US	23.2
E001-E0FF	*Reserved*		
E100-E7FF	*Reserved for use as Change Sensitivity Percent modifier range*		
E800-EFFF	*Reserved*		
F000	Modifier: Vendor Reserved [12]	US	23.2
F001-F0FF	*Reserved*		
F100-F7FF	*Reserved for use as Vendor Reserved modifier range*		
F800-FFFF	*Reserved*		

Table 23.1: Sensors Page

23.1 Sensor Device Usages

Usage Name	Usage Type	Description
Sensor	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.
Biometric	CA/CP	An application-level or physical collection that identifies a device that detects biometric information.
Biometric: Blood Pressure	CA/CP	An application-level or physical collection that identifies a device that measures the systolic/diastolic blood pressure of the device user.
Biometric: Body Temperature	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.
Biometric: Heart Rate	CA/CP	An application-level or physical collection that identifies a device that measures the heart rate of the device user.
Biometric: Heart Rate Variability	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.
Biometric: Human Presence	CA/CP	An application-level or physical collection that identifies a device that detects human presence (Boolean yes or no).
Biometric: Human Proximity	CA/CP	An application-level or physical collection that identifies a device that detects human proximity (range of values).
Biometric: Human Touch	CA/CP	An application-level or physical collection that identifies a device that registers human touch. *This is not to be confused with single-touch or multi-touch digitizers that provide finger position coordinates.*
Biometric: Peripheral Oxygen Saturation	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.
Biometric: Respiratory Rate	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.
Electrical	CA/CP	An application-level or physical collection that identifies a device that measures electrical information.
Electrical: Capacitance	CA/CP	An application-level or physical collection that identifies a device that measures electrical capacitance.
Electrical: Current	CA/CP	An application-level or physical collection that identifies a device that measures electrical current, such as an ammeter.
Electrical: Frequency	CA/CP	An application-level or physical collection that identifies a device that measures electrical frequency, such as a frequency meter.
Electrical: Period	CA/CP	An application-level or physical collection that identifies a device that measures electrical period, such as a period meter.
Electrical: Potentiometer	CA/CP	An application-level or physical collection that identifies a device that measures percent of range, such as a potentiometer.
Electrical: Power	CA/CP	An application-level or physical collection that identifies a device that measures electrical power, such as a wattmeter.

Electrical: Inductance	CA/CP	An application-level or physical collection that identifies a device that measures electrical inductance.
Electrical: Resistance	CA/CP	An application-level or physical collection that identifies a device that measures electrical resistance, such as an ohmmeter or a potentiometer.
Electrical: Voltage	CA/CP	An application-level or physical collection that identifies a device that measures electrical voltage, such as a voltmeter.
Environmental	CA/CP	An application-level or physical collection that identifies a device that measures environmental information.
Environmental: Air Quality	CA/CP	An application-level or physical collection that identifies a device that measures the amount of pollutants in the air.
Environmental: Atmospheric Pressure	CA/CP	An application-level or physical collection that identifies a device that measures atmospheric pressure, such as a barometer.
Environmental: Heat Index	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.
Environmental; Humidity	CA/CP	An application-level or physical collection that identifies a device that measures humidity, such as a hygrometer.
Environmental: Object Presence	CA/CP	An application-level of physical collection that identifies a device that detects object presence (Boolean yes or no).
Environmental: Object Proximity	CA/CP	An application-level or physical collection that identifies a device that detects object proximity (range of values).
Environmental: Surface Temperature	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.
Environmental: Temperature	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).
Environmental: Volatile Organic Compounds	CA/CP	An application-level or physical collection that identifies a device that measures the amount of volatile organic compounds in the air.
Environmental: Wind Direction	CA/CP	An application-level or physical collection that identifies a device that measures wind direction, such as a weather vane.
Environmental: Wind Speed	CA/CP	An application-level or physical collection that identifies a device that measures wind speed, such as an anemometer.
Gesture	CA/CP	An application-level of physical collection that identifies a sensor that can detect system physical manipulation gesture by an external agent.
Gesture: Chassis Flip Gesture	CA/CP	An application-level or physical collection that identifies a sensor that can detect chassis flip gesture of a system. see Section 23.20.2.1 Chassis Flip Gesture
Gesture: Hinge Fold Gesture	CA/CP	An application-level or physical collection that identifies a sensor that can detect a hinge fold gesture. see Section 23.20.2.2 Hinge Fold Gesture
Light	CA/CP	An application-level or physical collection that identifies a device that measures light information.

Light: Ambient Light	CA/CP	An application-level or physical collection that identifies a device that detects ambient light.
Light: Consumer Infrared	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.
Light: Infrared Light	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).
Light: Visible Light	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).
Light: Ultraviolet Light	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).
Location	CA/CP	An application-level or physical collection that identifies a device that can report location information.
Location: Broadcast	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).
Location: Dead Reckoning	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).
Location: GPS (Global Positioning System)	CA/CP	An application-level or physical collection that identifies a device that detects the current location using the GPS (Global Positioning Satellite) system.
Location: Lookup	CA/CP	An application-level or physical collection that identifies a device that detects the current location using the computers current IP Address.
Location: Other	CA/CP	An application-level or physical collection that identifies a device that detects the current location using other means.
Location: Static	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.
Location: Triangulation	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.
Mechanical	CA/CP	An application-level or physical collection that identifies a device that can report mechanical information.
Mechanical: Boolean Switch	CA/CP	An application-level or physical collection that identifies a device that can switch between two states: on and off.
Mechanical: Boolean Switch Array	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.
Mechanical: Multivalue Switch	CA/CP	An application-level or physical collection that identifies a device that can switch between multiple states.
Mechanical: Force	CA/CP	An application-level or physical collection that identifies a device that measures force.

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

Orientation: Compass 3D	CA/CP	An application-level or physical collection that identifies a three-axis compass.
Orientation: Inclinometer 1D	CA/CP	An application-level or physical collection that identifies a one-axis tilt meter.
Orientation: Inclinometer 2D	CA/CP	An application-level or physical collection that identifies a two-axis tilt meter.
Orientation: Inclinometer 3D	CA/CP	An application-level or physical collection that identifies a three-axis tilt meter.
Orientation: Distance 1D	CA/CP	An application-level or physical collection that identifies a device that measures distance using one axis.
Orientation: Distance 2D	CA/CP	An application-level or physical collection that identifies a device that measures distance using two axes.
Orientation: Distance 3D	CA/CP	An application-level or physical collection that identifies a device that measures distance using three axes.
Orientation: Device Orientation	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).
Orientation: Compass	CA/CP	An application-level or physical collection that identifies a compass with any number of axes.
Orientation: Inclinometer	CA/CP	An application-level or physical collection that identifies a tilt meter with any number of axes.
Orientation: Distance	CA/CP	An application-level or physical collection that identifies a device that measures distance using any number of axes.
Orientation: Relative Orientation	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.
Orientation: Simple Orientation	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.
Orientation: Extended: Geomagnetic Orientation	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.
Orientation: Extended: Magnetometer	CA/CP	An application-level or physical collection that identifies a device that measures magnetic field strengths.
Other	CA/CP	An application-level or physical collection that identifies a device that does not fit into any of the other pre-defined categories.
Other: Custom	CA/CP	An application-level or physical collection that identifies a device that conforms to the *custom* sensor specification.
Other: Generic	CA/CP	An application-level or physical collection that identifies a device that conforms to the *generic* sensor specification.
Other: Generic Enumerator	CA/CP	An application-level or physical collection that identifies a device that conforms to the *generic enumerator* specification.
Other: Hinge Angle	CA/CP	An application-level or physical collection that identifies a sensor that measures the hinge angle.

Personal Activity	CA/CP	An application-level or physical collection that identifies a device that measures information regarding personal, day-to-day activities a user experiences.
Personal Activity: Activity Detection	CA/CP	An application-level or physical collection that identifies a device that measures confidence levels for detecting the device user's current activity.
Personal Activity: Device Position	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.
Personal Activity: Floor Tracker	CA/CP	An application-level or physical collection that identifies a device that detects the current elevation (in building 'floors').
Personal Activity: Pedometer	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.
Personal Activity: Step Detection	CA/CP	An application-level or physical collection that identifies a device that detects when the user has taken a step.
Scanner	CA/CP	An application-level or physical collection that identifies a device that reports information from scanning devices.
Scanner: Barcode	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 Barcode Scanner Page (`0x8C`)
Scanner: RFID	CA/CP	An application-level or physical collection that identifies a device that is used for radio-frequency scanning of tags.
Scanner: NFC	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.
Time	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.
Time: Alarm Timer	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.
Time: Real Time Clock	CA/CP	An application-level or physical collection that identifies a device that can report current time, most often used for timestamping sensor samples.
Vendor Reserved 1	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 2	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 3	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 4	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 5	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 6	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 7	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 8	CA/CP	Reserved for use by Vendors/OEMs

Vendor Reserved 9	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 10	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 11	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 12	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 13	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 14	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 15	CA/CP	Reserved for use by Vendors/OEMs
Vendor Reserved 16	CA/CP	Reserved for use by Vendors/OEMs

23.2 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 *Temperature, Degrees Celsius*, and the absolute sensitivity is *3* then that would mean *change of* $\pm$*3 Degrees Celsius*.
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 *Temperature, Degrees Celsius*, the Minimum is -4.0, the Maximum is +40.0, and the percent of range sensitivity is *5* then that would mean *change of 5% of -4.0 to +40.0 Degrees Celsius*, (i.e., ±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 *prior reading*. For example, if the data field is *Temperature, Degrees Celsius*, the prior reading was +24.0, and the percent relative sensitivity is *4* then that would mean *change of 4% from 24.0 Degrees Celsius*, (i.e., ±0.96 Degrees Celsius).
Modifier: Vendor Reserved	US	F	Reserved for use by Vendors as a Vendor specific Modifier.

23.3 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
Event: Sensor State	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.

23.4 Sensor Event Usages

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

The `Event: Sensor Event` field us usually part of the Input report Event and indicate the reason for the receipt of the input report.

Usage Name	Usage Type	Description
Event: Sensor Event	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.

23.5 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 *set/use device default value*, 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 a 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.

23.5.1 Property: Sensor Connection Types

Usage Name	Usage Type	Description
Property: Sensor Connection Type	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.

23.5.2 Property: Reporting State

Usage Name	Usage Type	Description
Property: Reporting State	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.
Reporting State: All	Sel	

23.5.3 Property: Power State

Usage Name	Usage Type	Description
Property: Power State	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.

23.5.4 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.

23.6 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 *out of range* 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 specifycing 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.
Data Field: Human Attention Detected	MC	Indicates the user's attention has been detected. (e.g. when the user is facing towards the system integrated with the sensor).
Property: Human Presence Detection Type	NAry	Indicates use of biometric data to detect human presence. The Host can then define its own policy for what it considers to be privacy-sensitive.
Human Presence Detection Type: Vendor-Defined Non-Biometric	Sel	Presence (of one or more people) is detected utilizing a vendor-defined, but non-biometric method. This is used to give positive affirmation that the sensor is using detection unrelated to biometrics as defined below. Without this, a Host cannot assume biometrics aren't utilized by the device.

Human Presence Detection Type: Vendor-Defined Biometric	Sel	Presence (of one or more people) is detected utilizing vendor-defined human biometrics. This is a catch-all for a Human Presence sensor that utilizes biometrics not already defined below.
Human Presence Detection Type: Facial Biometric	Sel	Human presence is detected by scanning (e.g. by a low-resolution video camera) for human faces (e.g. using Viola-Jones object detection). Distinguishing between faces or detection of facial attributes is not performed. Such detection is similar to that of existing digital cameras that can place a bounding-box around a face.
Human Presence Detection Type: Audio Biometric	Sel	Human presence is detected by scanning (e.g. by a microphone) for 'human' sounds (e.g. a predefined keyword, general talking, loud noises, clapping). Distinguishing between voices/users or detection of audio characteristics are not performed.

23.6.1 Multi-person Detection

Usage Name	**Usage Type**	**Description**
Data Field: Human Head Azimuth	SV	Indicates the azimuth angle in degrees at which a person's head is located relative to the device.
Data Field: Human Head Altitude	SV	Indicates the altitude angle in degrees at which a person's head is located relative to the device.
Data Field: Human Head Roll	SV	Indicates the Roll angle of a person's head in degrees relative to the device.
Data Field: Human Head Pitch	SV	Indicates the Pitch angle of a person's head in degrees relative to the device.
Data Field: Human Head Yaw	SV	Indicates the Yaw angle of a person's head in degrees relative to the device.
Data Field: Human Correlation Id	SV	Indicates a non-persistent correlation identifier of a person within the current session. The session is implementation specific, e.g., it may be the sensor's current active power state cycle. The purpose of this identifier is to distinguish people from one another as they move within the sensor's field of view.

23.6.1.1 Head Position Parameters

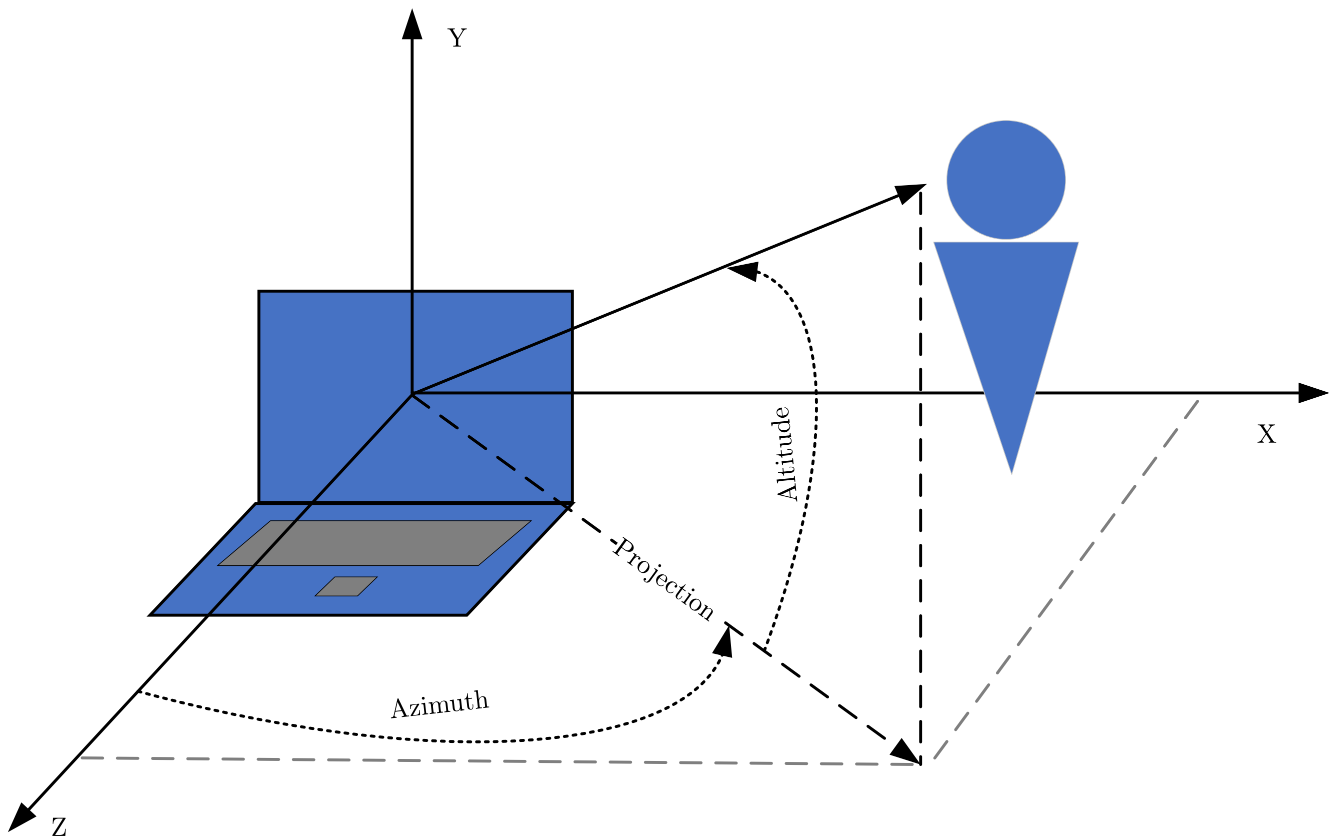


Figure 23.1: Head Position

- The head position is specified as Azimuth and Altitude angles.
- Azimuth is the angle between Z axis and XZ-projection of the vector pointing from the device to the center of the person's face. Range [-90, 90]. The angle value is positive in the counterclockwise rotation around Y axis.
- Altitude is the angle between the vector pointing from the device to the center of the person's face and its XZ-projection. Range [-90, 90]. Positive values specify an angle toward the positive Y axis.
- The conventions for X, Y, Z axes and rotation angles are aligned with conventions used for Motion and Orientation sensors, which are based on W3C Device Orientation Draft Specification. This simplifies exposing Sensors API to W3C in future, to be consumed in Progressive Web Apps and other web applications.
- Axes start at the center of the device's screen.
- The center of the person's face is considered a point between the eyes.
- The X axis is in the plane of the device's screen and is positive towards the right hand side of the screen from the perspective of a user facing the device.
- The Y axis is in the plane of the screen is positive towards the top of the screen.
- The Z is perpendicular to the screen, positive toward a user facing the device.
- Axes are fixed relative to the device and don't change with the device's rotation.
- For non screen-based devices the axes are defined relative to the devices' front panel.

23.6.1.2 Head Orientation Parameters

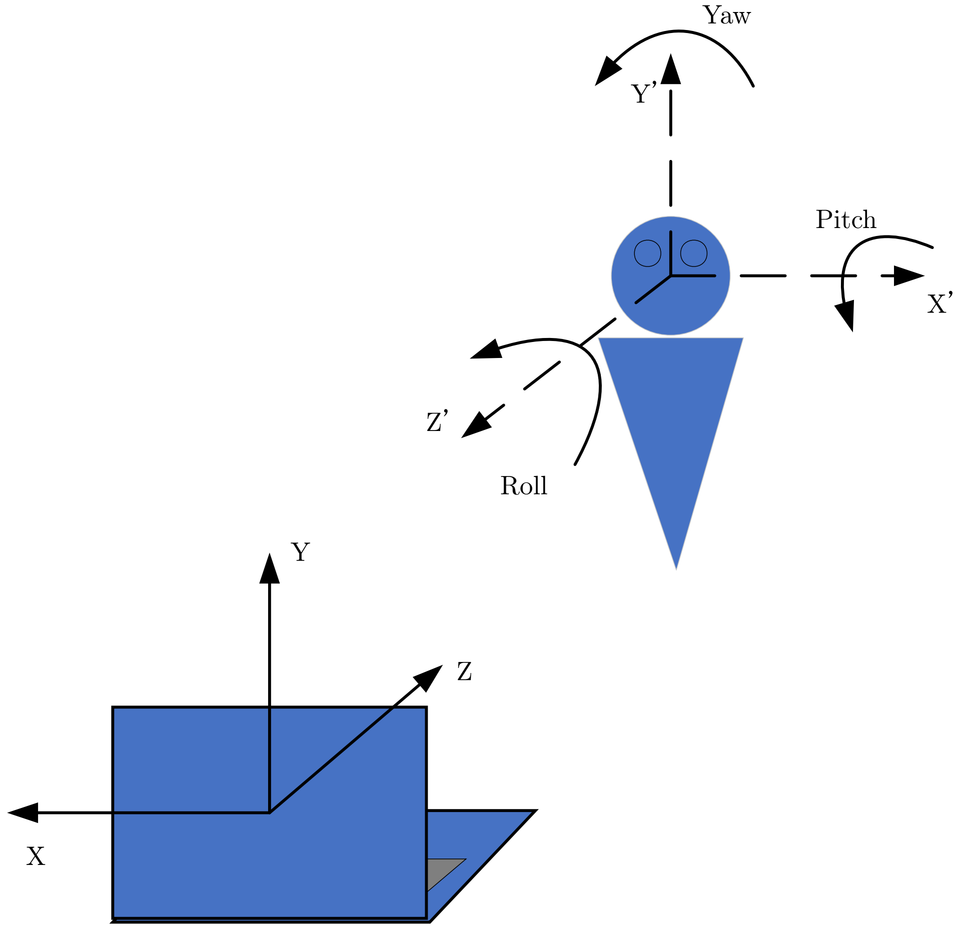


Figure 23.2: Head Position

- The head orientation is specified in intrinsic Tait-Bryan angles applied in Roll, Pitch, Yaw order.
- Roll is the counterclockwise rotation of the person's head around Z' axis, in degrees. Range [0, 360). In the zero position the Z' axis is parallel to the device's Z axis and points from the center of the person's face towards the device.
- Pitch is the counterclockwise rotation of the person's head around X' axis, in degrees. Range [-180, 180). In the zero position the X' axis is parallel to the device's X axis and points from the center of the person's face rightwards from the device's perspective.
- Yaw is the counterclockwise rotation of the person's head around Y' axis, in degrees. Range [-90, 90). In the zero position the Y' axis is parallel to the device's Y axis and points from the center of the person's face upwards.

23.7 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.

23.8 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 *out of range* 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 *1976 US Standard Atmosphere* air pressure at Sea Level Pressure. Default unit of measure is bars; can be overridden using explicit Unit and/or Unit Exponent.

23.9 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^2, 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^2, 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^2, 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^2, 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^2, 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^2, 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^2, can be overridden using explicit Unit and/or Unit Exponent.

These properties are commonly supported by light sensors.

Usage Name	Usage Type	Description
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.

23.10 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.

23.10.1 Location Desired Accuracy

Usage Name	**Usage Type**	**Description**
Property: Location Desired Accuracy	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.

23.10.2 Fix Quality

Usage Name	Usage Type	Description
Data Field: Fix Quality	NAry	Indicates fix quality.
Fix Quality: No Fix	Sel	No Fix
Fix Quality: GPS	Sel	GPS
Fix Quality: DGPS	Sel	DPGS

23.10.3 Fix Type

Usage Name	Usage Type	Description
Data Field: Fix Type	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

23.10.4 GPS Operation Mode

Usage Name	Usage Type	Description
Data Field: GPS Operation Mode	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.

23.10.5 GPS Selection Mode

Usage Name	Usage Type	Description
Data Field: GPS Selection Mode	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

23.10.6 GPS Status

Usage Name	Usage Type	Description
Data Field: GPS Status	NAry	Indicates current GPS data status
GPS Status Data: Valid	Sel	Data Valid.
GPS Status Data: Not Valid	Sel	Data Not Valid.

23.11 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: Multivalue Switch Value	SV	Reports the multivalue state of a Multivalue 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.

23.12 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.

23.13 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 *out of range* 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.

23.13.1 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
Data Field: Magnetometer Accuracy	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.

23.13.2 Simple Orientation Direction

Usage Name	Usage Type	Description
Data Field: Simple Orientation Direction	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.

23.14 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).

23.15 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 `_time64()` 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., *goes off*).

23.15.1 Day of Week

Usage Name	Usage Type	Description
Data Field: Day of Week	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

23.16 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.

23.17 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.

23.18 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 *inline* 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 *inline* 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 *inline* 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 *inline* 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 *inline* 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 *Enumerator* 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 *Enumerator* 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 *Enumerator* top-level-collection strategy, this usage specifies the Row index of the Enumerator's table.

Property: Enumerator Table Row Count	SV	When using the *Enumerator* top-level-collection strategy, this usage specifies the total count of Rows in the Enumerator's table.

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 *Enumerator* top-level-collection strategy, this usage specifies the Row index of the Enumerator's table.
Property: Enumerator Table Row Count	SV	When using the *Enumerator* top-level-collection strategy, this usage specifies the total count of Rows in the Enumerator's table.

23.18.1 Generic GUID or PROPERTYKEY kind

Usage Name	**Usage Type**	**Description**
Data Field: Generic GUID or PROPERTYKEY kind	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.

23.18.2 Generic Firmware VARTYPE

Usage Name	**Usage Type**	**Description**
Data Field: Generic Firmware VARTYPE	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

23.18.3 Generic Unit of Measure

Usage Name	**Usage Type**	**Description**
Data Field: Generic Unit of Measure	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

23.18.4 Generic Unit Exponent

Usage Name	**Usage Type**	**Description**
Data Field: Generic Unit Exponent	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

23.19 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.
Property: Supported Activity Types	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.
Property: Subscribed Activity Types	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.
Property: Supported Step Types	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.
Property: Subscribed Step Types	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.

23.19.1 Activity Types

Usage Name	Usage Type	Description
Data Field: Activity Type	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.

23.19.2 Activity State

Usage Name	Usage Type	Description
Data Field: Activity State	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

23.19.3 Device Position

Usage Name	Usage Type	Description
Data Field: Device Position	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.

23.19.4 Step Type

Usage Name	Usage Type	Description
Data Field: Step Type	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: Walking	Sel	The footsteps were taken while the device user was walking.
Step Type: Running	Sel	The footsteps were taken while the device user was running.

23.20 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.

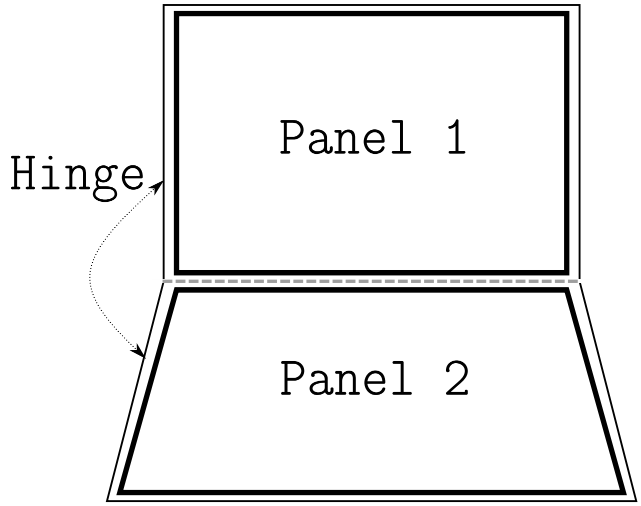


Figure 23.3: Foldable Device

23.20.1 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 Section 23.2 Modifiers

23.20.2 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.

23.20.2.1 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).

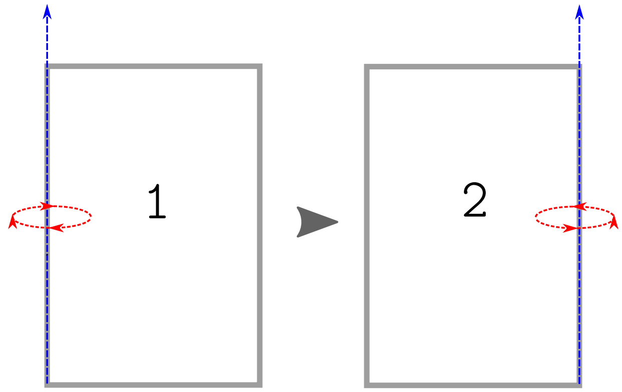


Figure 23.4: Chassis Flip Gesture

23.20.2.2 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.

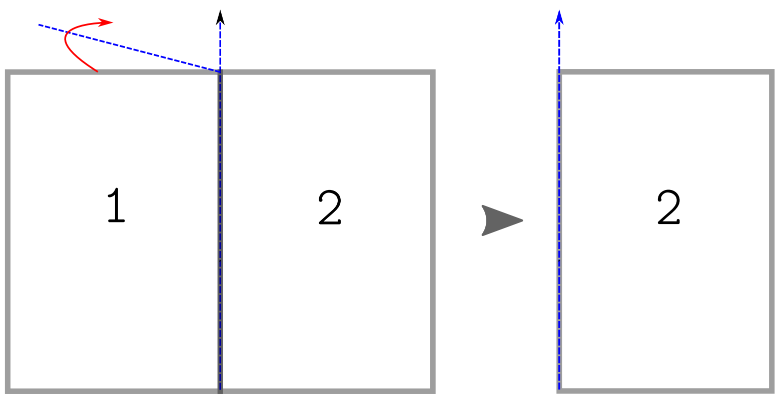


Figure 23.5: Hinge Fold Gesture

23.20.2.3 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.

23.20.2.4 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
Data Field: Gesture State	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.

23.20.2.5 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
Data Field: Hinge Fold Contributing Panel	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

23.20.2.6 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
Data Field: Hinge Fold Type	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)

24 Medical Instrument Page (0x40)

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Medical Ultrasound**	CA	24.1
02-1F	*Reserved*		
20	VCR/Acquisition	OOC	24.2
21	Freeze/Thaw	OOC	24.2
22	Clip Store	OSC	24.2
23	Update	OSC	24.2
24	Next	OSC	24.2
25	Save	OSC	24.2
26	Print	OSC	24.2
27	Microphone Enable	OSC	24.2
28-3F	*Reserved*		
40	Cine	LC	24.2
41	Transmit Power	LC	24.2
42	Volume	LC	24.2
43	Focus	LC	24.2
44	Depth	LC	24.2
45-5F	*Reserved*		
60	Soft Step - Primary	LC	24.2
61	Soft Step - Secondary	LC	24.2
62-6F	*Reserved*		
70	Depth Gain Compensation	LC	24.3
71-7F	*Reserved*		
80	Zoom Select	OSC	24.4
81	Zoom Adjust	LC	24.4
82	Spectral Doppler Mode Select	OSC	24.4
83	Spectral Doppler Adjust	LC	24.4
84	Color Doppler Mode Select	OSC	24.4
85	Color Doppler Adjust	LC	24.4
86	Motion Mode Select	OSC	24.4
87	Motion Mode Adjust	LC	24.4
88	2-D Mode Select	OSC	24.4
89	2-D Mode Adjust	LC	24.4
8A-9F	*Reserved*		
A0	Soft Control Select	OSC	24.4
A1	Soft Control Adjust	LC	24.4
A2-FFFF	*Reserved*		

Table 24.1: Medical Instrument Page

24.1 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.

24.2 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.

24.3 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.

24.4 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.

25 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	*Undefined*		
01	**Braille Display**	CA	25.1
02	**Braille Row**	NAry	25.2
03	8 Dot Braille Cell	DV	25.2
04	6 Dot Braille Cell	DV	25.2
05	Number of Braille Cells	DV	25.2
06	**Screen Reader Control**	NAry	25.5
07	Screen Reader Identifier	DV	25.6
08-F9	*Reserved*		
FA	**Router Set 1**	NAry	25.3
FB	**Router Set 2**	NAry	25.3
FC	**Router Set 3**	NAry	25.3
FD-FF	*Reserved*		
100	Router Key	Sel	25.3
101	Row Router Key	Sel	25.3
102-1FF	*Reserved*		
200	**Braille Buttons**	NAry	25.4
201	Braille Keyboard Dot 1	Sel	25.4
202	Braille Keyboard Dot 2	Sel	25.4
203	Braille Keyboard Dot 3	Sel	25.4
204	Braille Keyboard Dot 4	Sel	25.4
205	Braille Keyboard Dot 5	Sel	25.4
206	Braille Keyboard Dot 6	Sel	25.4
207	Braille Keyboard Dot 7	Sel	25.4
208	Braille Keyboard Dot 8	Sel	25.4
209	Braille Keyboard Space	Sel	25.4
20A	Braille Keyboard Left Space	Sel	25.4
20B	Braille Keyboard Right Space	Sel	25.4
20C	**Braille Face Controls**	NAry	25.4
20D	**Braille Left Controls**	NAry	25.4
20E	**Braille Right Controls**	NAry	25.4
20F	**Braille Top Controls**	NAry	25.4
210	Braille Joystick Center	Sel	25.4
211	Braille Joystick Up	Sel	25.4
212	Braille Joystick Down	Sel	25.4
213	Braille Joystick Left	Sel	25.4

214	Braille Joystick Right	Sel	25.4
215	Braille D-Pad Center	Sel	25.4
216	Braille D-Pad Up	Sel	25.4
217	Braille D-Pad Down	Sel	25.4
218	Braille D-Pad Left	Sel	25.4
219	Braille D-Pad Right	Sel	25.4
21A	Braille Pan Left	Sel	25.4
21B	Braille Pan Right	Sel	25.4
21C	Braille Rocker Up	Sel	25.4
21D	Braille Rocker Down	Sel	25.4
21E	Braille Rocker Press	Sel	25.4
21F-FFFF	*Reserved*		

Table 25.1: Braille Display Page

25.1 Braille Display Device

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

25.2 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
Braille Row	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[1].
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[1].
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

[1] http://www.unicode.org/versions/Unicode5.2.0/ch15.pdf

25.3 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
Router Set 1	NAry	Primary router. Performs the same action as Button 1, Primary Button would perform with a pointer device.
Router Set 2	NAry	Secondary Router. Performs the same action as Button 2, Secondary Button would perform with a pointer device.
Router Set 3	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.

25.4 Braille Buttons

Usage Name	Usage Type	Description
Braille Buttons	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	
Braille Face Controls	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.
Braille Left Controls	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.
Braille Right Controls	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.
Braille Top Controls	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	

25.5 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 n, respectively.

25.6 Screen Reader Identifier

Usage Name	Usage Type	Description
Screen Reader Identifier	DV	A 128 bit UUID identifying the active screen reader which is being interfaced with the Braille display. This identifier may be optional observed by the braille display to infer the behavior of Screen Reader Controls. 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 n. 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.

26 Lighting And Illumination Page (0x59)

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**LampArray**	CA	26.1
02	**LampArrayAttributesReport**	CL	26.2
03	LampCount	SV/DV	26.2
04	BoundingBoxWidthInMicrometers	SV	26.2
05	BoundingBoxHeightInMicrometers	SV	26.2
06	BoundingBoxDepthInMicrometers	SV	26.2
07	LampArrayKind	SV	26.2
08	MinUpdateIntervalInMicroseconds	SV	26.2
09-1F	*Reserved*		
20	**LampAttributesRequestReport**	CL	26.3
21	LampId	SV/DV	26.3
22	**LampAttributesResponseReport**	CL	26.3
23	PositionXInMicrometers	DV	26.3
24	PositionYInMicrometers	DV	26.3
25	PositionZInMicrometers	DV	26.3
26	LampPurposes	DV	26.3
27	UpdateLatencyInMicroseconds	DV	26.3
28	RedLevelCount	DV	26.3
29	GreenLevelCount	DV	26.3
2A	BlueLevelCount	DV	26.3
2B	IntensityLevelCount	DV	26.3
2C	IsProgrammable	DV	26.3
2D	InputBinding	DV	26.3
2E-4F	*Reserved*		
50	**LampMultiUpdateReport**	CL	26.4
51	RedUpdateChannel [67]	DV	26.4
52	GreenUpdateChannel [67]	DV	26.4
53	BlueUpdateChannel [67]	DV	26.4
54	IntensityUpdateChannel [67]	DV	26.4
55	LampUpdateFlags [67]	DV	26.4
56-5F	*Reserved*		
60	**LampRangeUpdateReport**	CL	26.4
61	LampIdStart	DV	26.4
62	LampIdEnd	DV	26.4
63-6F	*Reserved*		
70	**LampArrayControlReport**	CL	26.5
71	AutonomousMode	DV	26.5
72-FFFF	*Reserved*		

26.1 Application Usages

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

26.2 LampArray Attributes Report

Usage Name	Usage Type	Description
LampArrayAttributesReport	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 Table 26.2.1 LampArrayKind Values
MinUpdateIntervalInMicroseconds	SV	Minimal time interval required between the `Host` sending two updates for any one Lamp.

26.2.1 LampArrayKind Values

Name	Description	`Value`
Undefined	*Undefined*	`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 funiture (e.g. chair, desk, bookcase)	`09`
LampArrayKindArt	LampArray is embedded in an artwork (e.g. painting, sculpture)	`0A`
LampArrayKindHeadset	LampArray is part of a headset (e.g. audio-headset). *Note: This is a specialization of LampArrayKindWearable*	`0B`
LampArrayKindMicrophone	LampArray is part of a standalone microphone. *Note: This is a specialization of LampArrayKindPeripheral*	`0C`

LampArrayKindSpeaker	LampArray is part of a standalone speaker. *Note: This is a specialization of LampArrayKindPeripheral*	`0D`
Reserved	*Reserved*	`0E-FFFF`
Vendor-Defined	Vendor-Defined	`10000-FFFFFFFF`

26.3 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 Table 26.3.1 LampPurposes Flags
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 Section 10 Keyboard/Keypad Page `(0x07)` or Button* Usages from Section 12 Button Page `(0x09)`

26.3.1 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`
Reserved	*Reserved*	`40-FFFF`
Vendor Defined	Vendor Defined	`10000-FFFFFFFF`

26.4 Lamp Update Reports

Usage Name	Usage Type	Description
LampMultiUpdateReport	CL	Applied to a collection containing updates for multiple Lamps, each Lamp specified can have a different color.
LampRangeUpdateReport	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	Red intensity of the new color for this LampId. Ignored unless Lamp IsProgrammable is true.
GreenUpdateChannel	DV	Green intensity of the new color for this LampId. Ignored unless Lamp IsProgrammable is true.
BlueUpdateChannel	DV	Blue intensity of the new color for this LampId. Ignored unless Lamp IsProgrammable is true.
IntensityUpdateChannel	DV	Intensity/gain overall of the new color for this LampId.
LampUpdateFlags	DV	Flags associated with a Lamp*Update message. See Table 26.4.1 LampUpdate Flags
LampIdStart	DV	The first LampId in the range of LampIds to update.
LampIdEnd	DV	The last LampId in the range of LampIds to update.

26.4.1 LampUpdate Flags

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

26.5 LampArray Control Report

Usage Name	Usage Type	Description
LampArrayControlReport	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.

26.6 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 (μm). For a signed 32bit integer (largest supported by HID), this gives a range from 1μm to >2km, which seems sufficient to describe any device.
- Time measurements to be given in microseconds (μs). For a signed 32bit integer (largest supported by HID), this gives a range from 1μs to >30minutes)

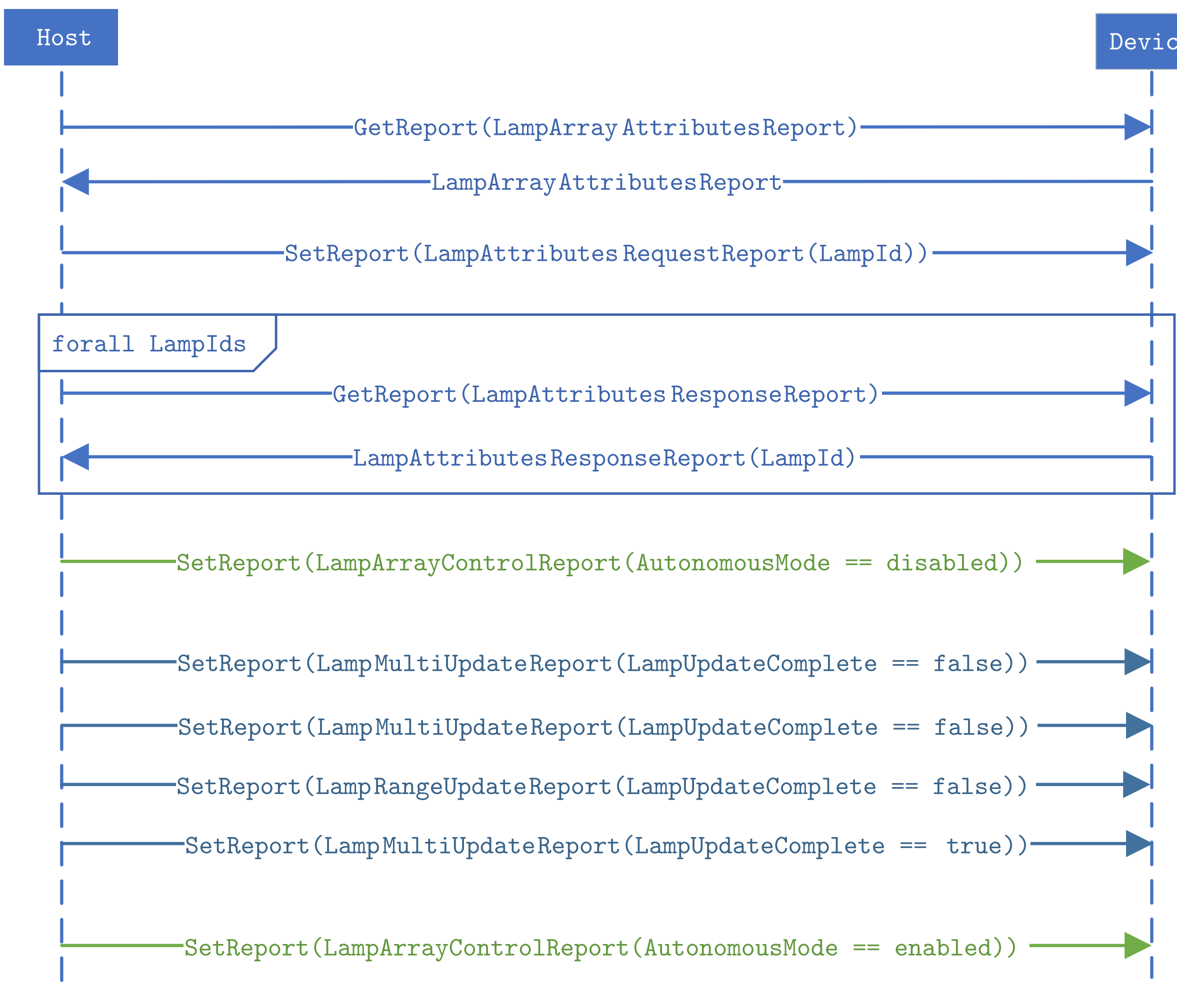


Figure 26.1: LampArray Operation

26.7 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 26.2.1 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[1]) 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 26.2, Figure 26.3 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.

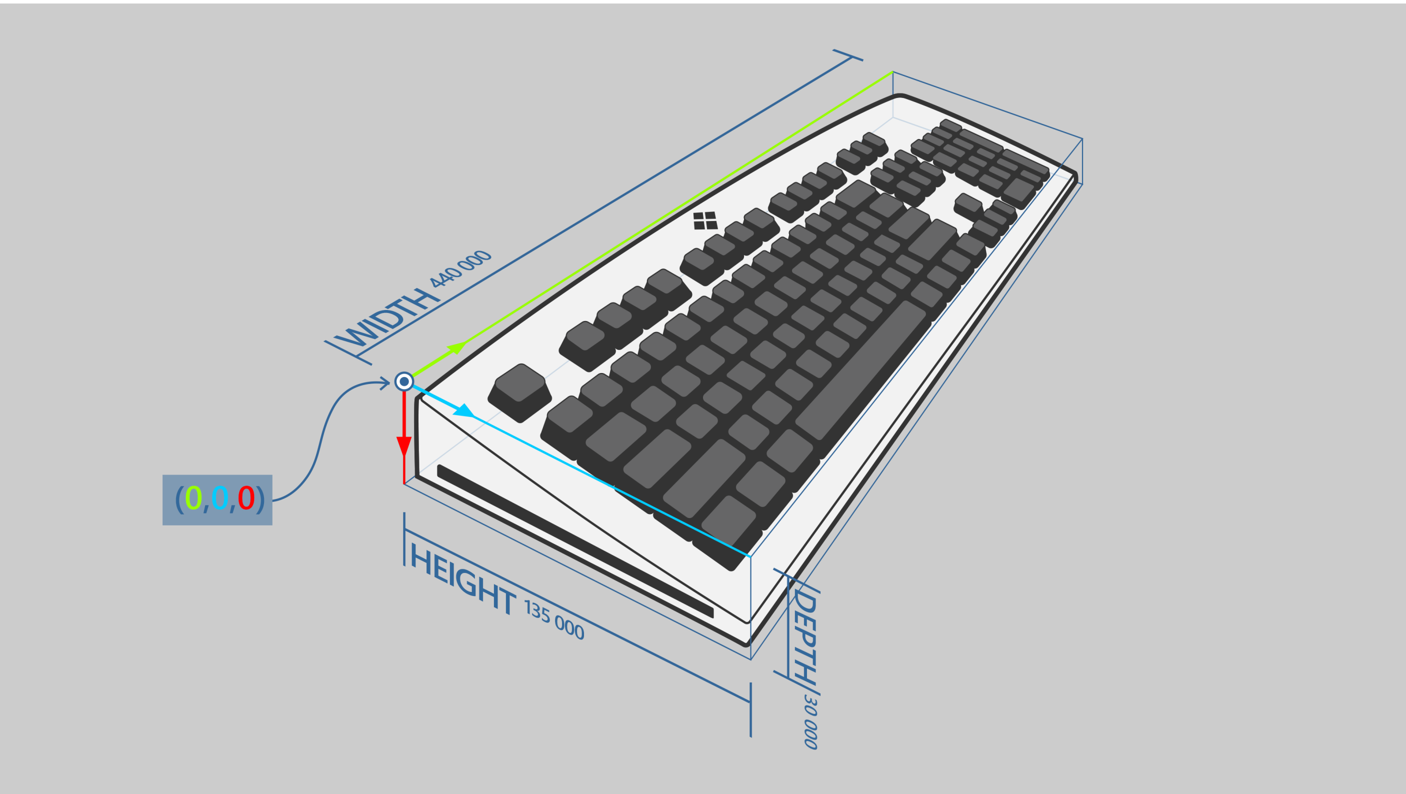


Figure 26.2: Keyboard with labeled dimensions and origin. Lamps exist beneath every key, the branding at the top/middle, and accent lighting along the left and right sides. Example sizes given for each dimension (in μm).

[1] https://usb.org/sites/default/files/documents/hid1_11.pdf

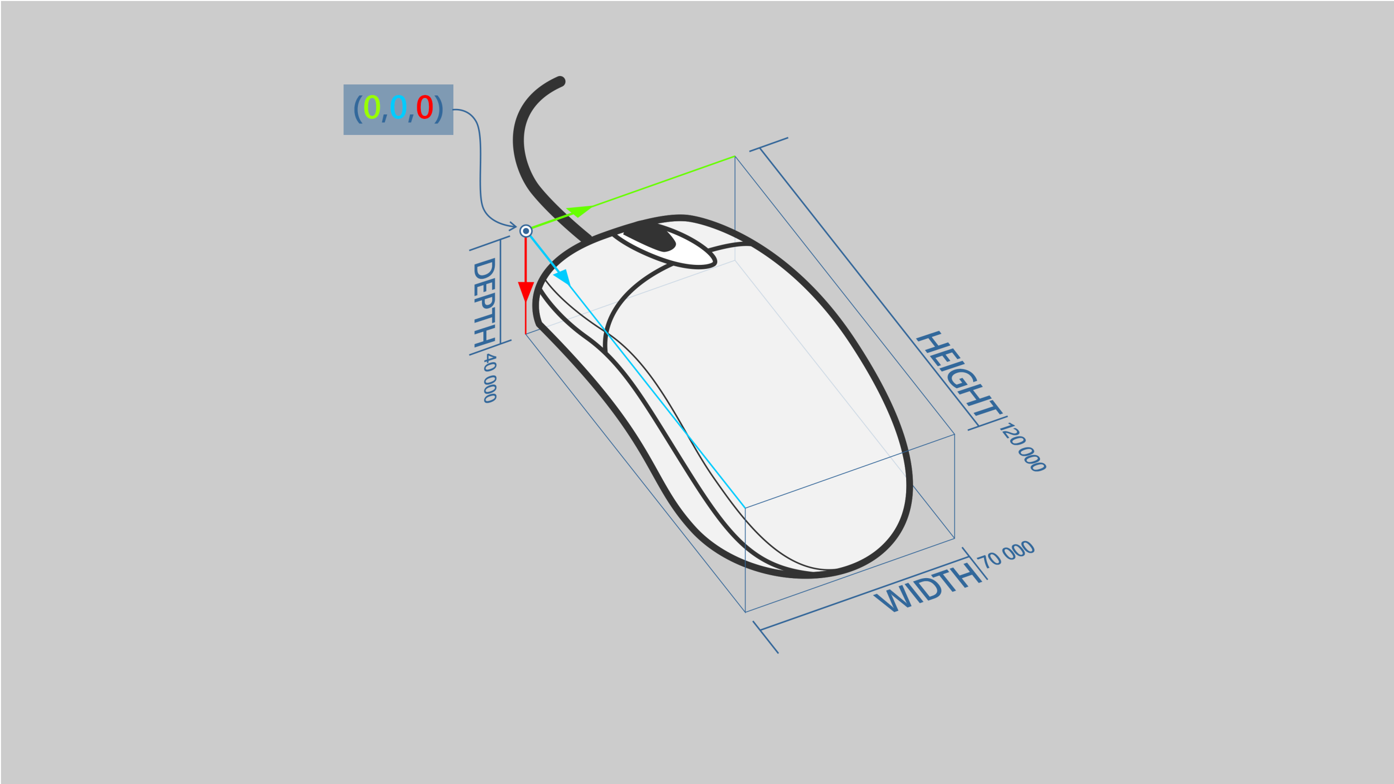


Figure 26.3: Mouse with labeled dimensions and origin. Example sizes given for each dimension (in μm).

`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.

26.8 Lamp Attributes and Interrogation

26.8.1 LampAttributesRequestReport

Having retrieved the `LampCount`, interrogation of a `Lamp` begins by the `Host` sending a `LampAttributes`**`Request`**`Report` (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.

26.8.2 LampAttributesResponseReport

The `Host` then requests a `LampAttributes`**`Response`**`Report` (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 `LampAttributes`**`Response`**`Report`, 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 `LampAttributes`**`Request`**`Report` for the first `LampId` to inspect (e.g. 0), then request multiple `LampAttributes`**`Response`**`Reports`; one for each further `Lamp` to inspect. Alternatively, a `Host` can explicitly send a `LampAttributes`**`Request`**`Report` before each `LampAttributes`**`Response`**`Report` 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`)

26.8.2.1 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	LampAttributes**Request**Report	OUT	0
2	LampAttributes**Response**Report	IN	0
3	LampAttributes**Response**Report	IN	1
4	LampAttributes**Response**Report	IN	2
5	LampAttributes**Response**Report	IN	3
6	LampAttributes**Response**Report	IN	4
7	LampAttributes**Response**Report	IN	5
8	LampAttributes**Response**Report	IN	0
9	LampAttributes**Request**Report	OUT	2
10	LampAttributes**Response**Report	IN	2
11	LampAttributes**Request**Report	OUT	4
12	LampAttributes**Response**Report	IN	4
13	LampAttributes**Response**Report	IN	5
14	LampAttributes**Response**Report	IN	0

26.8.3 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 26.7. 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 26.3.1 LampPurposes Flags .

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

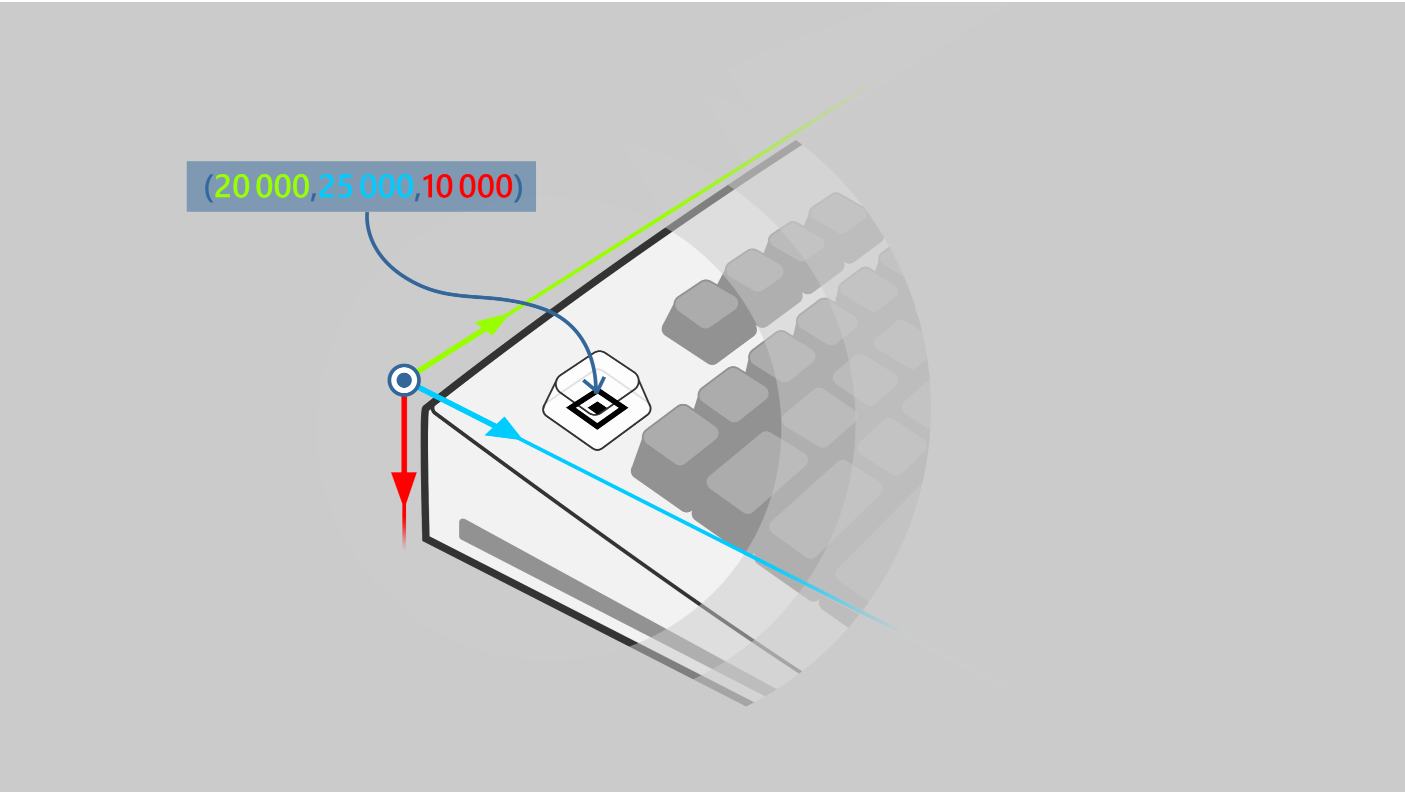


Figure 26.4: Keyboard control lamp under the esc key. Position of lamp relative to the bounding box (described above) labeled in μm.

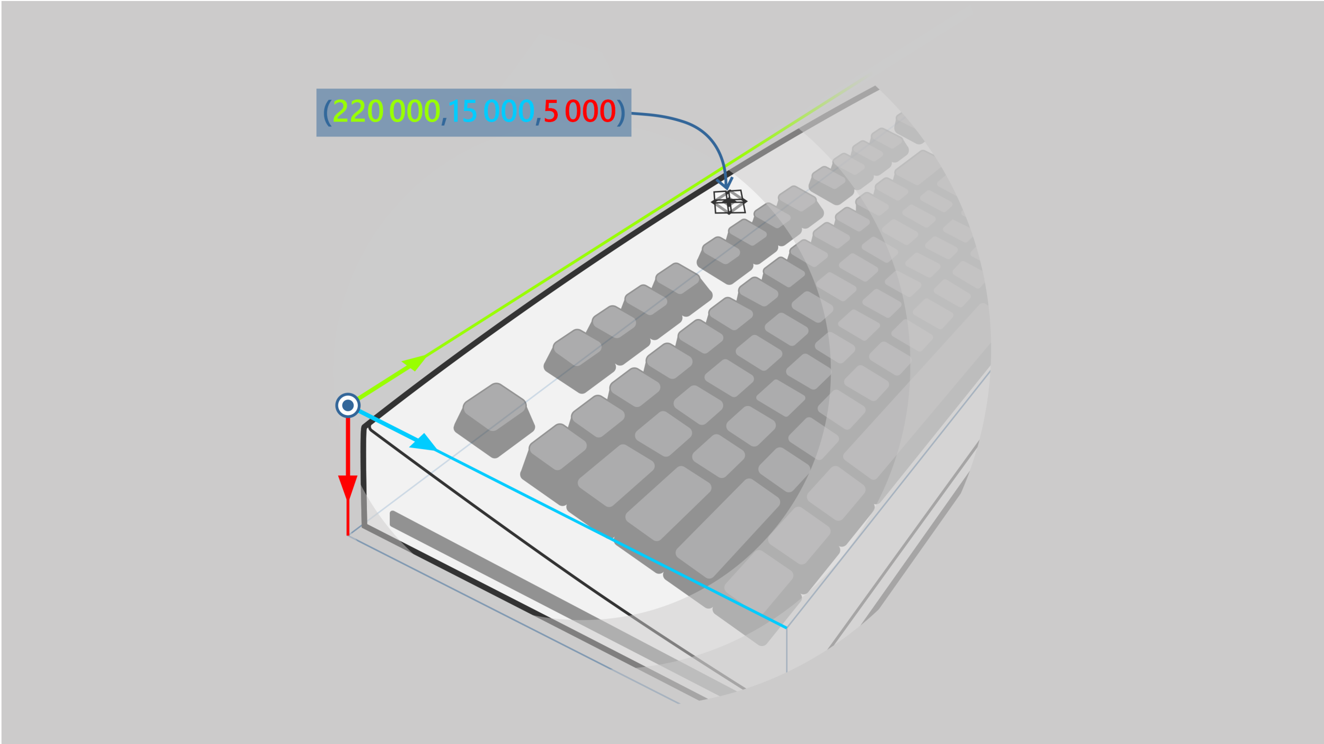


Figure 26.5: Keyboard branding lamp under the logo. Position of lamp relative to the bounding box (described above) labeled in μm.

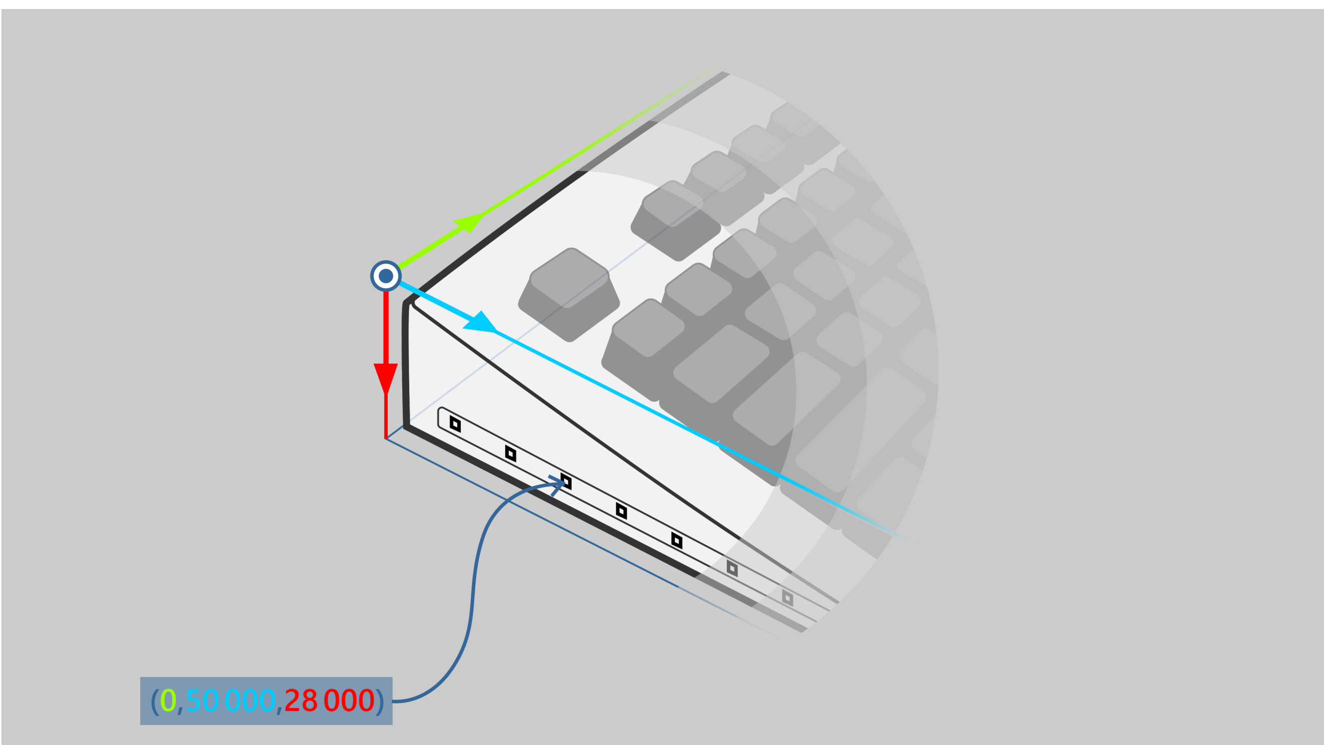


Figure 26.6: Accent lamp on the LHS (part of accent lighting). Position of lamp relative to the bounding box (described above) labeled in μm.

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.

26.9 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.

26.9.1 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.

26.10 LampArrayControlReport

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

26.10.1 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.

26.11 Updating Lamp State

Two reports are defined (Lamp**Multi**UpdateReport, Lamp**Range**UpdateReport) 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 it's 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.

26.11.1 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 >= Device LampCount
- *Channel > *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

26.11.2 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

27 Monitor Page (0x80)

This page and VESA Virtual Controls Page (0x82) define Usages for the management and control of system-attached monitors. This is the primary page for generic monitor control, with VESA Virtual Controls Page (0x82) giving specific support for the VESA MCCS VCP.

Note: VESA MCCS VCP controls are defined in their own UsagePage so they can have the same UsageIds as the externally defined VCP op-codes. If included in this UsagePage, collisions may occur after additions to the MCCS.

Note: At the time of writing (1998), USB 1.0 bandwidth (1.5Mbits) is insufficent for the actual transmission of video/audio data. It is only suitable for the transmission of management/control data.

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Monitor Control**	CA	27.1
02	EDID Information	SV	27.1
03	VDIF Information	SV	27.1
04	VESA Version	SV	27.1
05-FFFF	*Reserved*		

Table 27.1: Monitor Page

27.1 Monitor

While many monitor protocols define how video data is transmitted/formatted and the format for supported monitor characteristics, how those characteristics are retrieved from the monitor is not defined. That gap is filled here with HID Monitor Control.

Usage Name	Usage Type	Description
Monitor Control	CA	A device to manage and control a monitor through a sideband channel (e.g. USB). *Note: No video/audio data is sent through this device.*
EDID Information	SV	Extended Display Identification Data (EDID). Supersedes VDIF, conveying similar information in a more compact format.
VDIF Information	SV	Video Display Identification Format (VDIF). VDIF permits one or more pre-adjusted timings for each operational limit specified and the gamma table, if present, can have a large number of entries. This means the amount of information returned varies in length and can actually require several Kbytes of information to be returned by the monitor.
VESA Version	SV	The version of the VESA Monitor Control Command Set (MCCS) used by this device. If this field is set to zero (0), the monitor uses the MCCS VCP usages defined in VESA Virtual Controls Page (`0x82`). If this field is non-zero, it is a Binary-Coded Decimal (BCD) value representing the version number of the VESA Monitor Control Command Set (MCCS) used to define the monitor's VCP and command usage values.

28 Monitor Enumerated Page (0x81)

To simplify the implementation of a monitor implementing VESA MCCS (Monitor Control Command Set) VCP (Virtual Control Panel) (or similiar), UsageIds for controls in VESA Virtual Controls Page (0x82) are the same as their VESA op-code counterparts.

The returned VCP values for each control have context-specific meaning, varying for each control. Rather than assigning each control a seperate UsagePage (to prevent collisions) for its valid Sel values, each control defines a mapping between a Usage (Enum N) and a definition. This is seen as a good compromise between the requirements of a HID descriptor, uniqueness of UsageIds, and utilizing the existing values of VESA MCCS VCP.

e.g. for Usage Input Source Select , Enum 1 maps to DB-15HD/VGA1 and Enum 16 maps to S-Video1.

Usage ID	Usage Name	Usage Type
00	*Reserved*	
01	Enum 1	Sel
02	Enum 2	Sel
03	Enum 3	Sel
04	Enum 4	Sel
...	...	
FFFF	Enum 65535	Sel

Table 28.1: Monitor Enumerated Page

29 VESA Virtual Controls Page `(0x82)`

Defines controls for VESA supported monitor characteristics and control of monitor brightness, contrast, size, position, etc.

Each UsageId below is a Virtual Control Panel (VCP) op-code of the same id/value. All VCP op-codes are assigned by VESA (see VESA Monitor Command Set Standard (MCCS)).

> *Note: These defintions were first published in 1998, before the release of MCCS 1.0, and have not since been revised or validated against current supported MCCS versions.*

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	Degauss	DV	29.4
02-0F	*Reserved*		
10	Brightness	DV	29.1
11-11	*Reserved*		
12	Contrast	DV	29.1
13-15	*Reserved*		
16	Red Video Gain	DV	29.1
17-17	*Reserved*		
18	Green Video Gain	DV	29.1
19-19	*Reserved*		
1A	Blue Video Gain	DV	29.1
1B-1B	*Reserved*		
1C	Focus	DV	29.1
1D-1F	*Reserved*		
20	Horizontal Position	DV	29.1
21-21	*Reserved*		
22	Horizontal Size	DV	29.1
23-23	*Reserved*		
24	Horizontal Pincushion	DV	29.1
25-25	*Reserved*		
26	Horizontal Pincushion Balance	DV	29.1
27-27	*Reserved*		
28	Horizontal Misconvergence	DV	29.1
29-29	*Reserved*		
2A	Horizontal Linearity	DV	29.1
2B-2B	*Reserved*		
2C	Horizontal Linearity Balance	DV	29.1
2D-2F	*Reserved*		
30	Vertical Position	DV	29.1
31-31	*Reserved*		
32	Vertical Size	DV	29.1
33-33	*Reserved*		
34	Vertical Pincushion	DV	29.1
35-35	*Reserved*		
36	Vertical Pincushion Balance	DV	29.1

37-37	*Reserved*		
38	Vertical Misconvergence	DV	29.1
39-39	*Reserved*		
3A	Vertical Linearity	DV	29.1
3B-3B	*Reserved*		
3C	Vertical Linearity Balance	DV	29.1
3D-3F	*Reserved*		
40	Parallelogram Distortion (Key Balance)	DV	29.1
41-41	*Reserved*		
42	Trapezoidal Distortion (Key)	DV	29.1
43-43	*Reserved*		
44	Tilt (Rotation)	DV	29.1
45-45	*Reserved*		
46	Top Corner Distortion Control	DV	29.1
47-47	*Reserved*		
48	Top Corner Distortion Balance	DV	29.1
49-49	*Reserved*		
4A	Bottom Corner Distortion Control	DV	29.1
4B-4B	*Reserved*		
4C	Bottom Corner Distortion Balance	DV	29.1
4D-55	*Reserved*		
56	Horizontal Moiré	DV	29.1
57-57	*Reserved*		
58	Vertical Moiré	DV	29.1
59-5D	*Reserved*		
5E	Input Level Select	NAry	29.2
5F-5F	*Reserved*		
60	Input Source Select	NAry	29.2
61-6B	*Reserved*		
6C	Red Video Black Level	DV	29.1
6D-6D	*Reserved*		
6E	Green Video Black Level	DV	29.1
6F-6F	*Reserved*		
70	Blue Video Black Level	DV	29.1
71-A1	*Reserved*		
A2	Auto Size Center	NAry	29.3
A3-A3	*Reserved*		
A4	Polarity Horizontal Synchronization	NAry	29.3
A5-A5	*Reserved*		
A6	Polarity Vertical Synchronization	NAry	29.3
A7-A7	*Reserved*		
A8	Synchronization Type	NAry	29.3
A9-A9	*Reserved*		
AA	Screen Orientation	NAry	29.3

AB-AB	*Reserved*		
AC	Horizontal Frequency	DV	29.3
AD-AD	*Reserved*		
AE	Vertical Frequency	DV	29.3
AF-AF	*Reserved*		
B0	Settings	NAry	29.4
B1-C9	*Reserved*		
CA	On Screen Display	NAry	29.2
CB-D3	*Reserved*		
D4	Stereo Mode	NAry	29.2
D5-FFFF	*Reserved*		

Table 29.1: VESA Virtual Controls Page

29.1 VESA Virtual Controls

Usage Name	Usage Type	Description
Brightness	DV	The black level luminance of the display.
Contrast	DV	The ratio between the maximum and minimum luminance values.
Red Video Gain	DV	The level of maximum luminance of red pixels.
Green Video Gain	DV	The level of maximum luminance of green pixels.
Blue Video Gain	DV	The level of maximum luminance of blue pixels.
Focus	DV	Adjusts the apparent spot size.
Horizontal Position	DV	Moves the image toward the right side of the display.
Horizontal Size	DV	The distance between the left and right sides of the image.
Horizontal Pincushion	DV	Increasing (decreasing) this value causes the right and left sides of the image to become more (less) convex.
Horizontal Pincushion Balance	DV	Moves the center section of the image toward the right or left side of the display.
Horizontal Misconvergence	DV	Increasing (decreasing) this value will shift the red pixels to the right (left) across the image and the blue pixels left (right) across the image with respect to the green pixels.
Horizontal Linearity	DV	Shifts the density of pixels from the left and right ends to the center of the image.
Horizontal Linearity Balance	DV	Increasing (decreasing) this value shifts the density of pixels from the left (right) side to the right (left) side of the image.
Vertical Position	DV	Increasing (decreasing) this value moves the image toward the top (bottom) of the display.
Vertical Size	DV	The distance between the top and bottom of the image.
Vertical Pincushion	DV	Increasing (decreasing) this value causes the top and bottom sides of the image to become more (less) convex.
Vertical Pincushion Balance	DV	Increasing (decreasing) this value moves the center section of the image toward the top (bottom) of the display.
Vertical Misconvergence	DV	Increasing (decreasing) this value shifts the red pixels up (down) across the image and the blue pixels down (up) across the image with respect to the green pixels.
Vertical Linearity	DV	Increasing (decreasing) this value shifts the density of scan lines from the ends (center) to the center (ends) of the image.
Vertical Linearity Balance	DV	Increasing (decreasing) this value shifts the density of scan lines from the top (bottom) end to the bottom (top) end of the image.
Parallelogram Distortion (Key Balance)	DV	Increasing (decreasing) this value shifts the top section of the image to the right (left) with respect to the bottom section of the image.
Trapezoidal Distortion (Key)	DV	The ratio between the horizontal size at the top of the image relative to the horizontal size at the bottom of the image.
Tilt (Rotation)	DV	Increasing (decreasing) this value rotates the image (counter) clockwise about the center point of the image.
Top Corner Distortion Control	DV	The distance between the left and right side at the top end of the image.

Top Corner Distortion Balance	DV	Increasing (decreasing) this value moves the top end of the image to the right (left).
Bottom Corner Distortion Control	DV	The distance between the left and right side at the bottom end of the image.
Bottom Corner Distortion Balance	DV	Increasing (decreasing) this value moves the bottom end of the image to the right (value).
Horizontal Moiré	DV	Adjusting this value controls the horizontal picture moiré cancellation.
Vertical Moiré	DV	Adjusting this value controls the vertical picture moiré cancellation.
Red Video Black Level	DV	The level of minimum luminance of red pixels.
Green Video Black Level	DV	The level of minimum luminance of green pixels.
Blue Video Black Level	DV	The level of minimum luminance of blue pixels.

29.2 Read/Write

Usage Name	Usage Type	Description
Input Level Select	NAry	Changing this value chooses a different video input voltage for the display. Format is *reference white above blank, level of sync, below blank.* Mappings below are to the Usages on Monitor Enumerated Page `(0x81)` • Enum 0: None selected • Enum 1: 0.700, - 0.300 (1.00 Vpp) • Enum 2: 0.714, - 0.286 (1.00 Vpp) • Enum 3: 1.000, - 0.400 (1.40 Vpp) • Enum 4: 0.700, - 0.000 (0.70 Vpp)
Input Source Select	NAry	Changing this value selects a different video input source. Mappings below are to the Usages on Monitor Enumerated Page `(0x81)` • Enum 0: None selected • Enum 1: DB-15HD/VGA1 • Enum 2: DB-15HD/VGA2 • Enum 3: DB-15HD/VGA3 • Enum 4: BNC/RGB1 • Enum 5: BNC/RGB2 • Enum 6: BNC/RGB3 • Enum 7: EVC1 • Enum 8: EVC2 • Enum 9: EVC3 • Enum 10: MAC1 • Enum 11: MAC2 • Enum 12: MAC3 • Enum 13: RCA/Composite Video1 • Enum 14: RCA/Composite Video2 • Enum 15: RCA/Composite Video3 • Enum 16: S-Video1 • Enum 17: S-Video2 • Enum 18: S-Video3 • Enum 19: SCART-Composite1 • Enum 20: SCART-Composite2 • Enum 21: SCART-RGB • Enum 22: SCART-S-video • Enum 23: Tuner1 • Enum 24: Tuner2 • Enum 25: Tuner3 • Enum 26: YUV1 • Enum 27: YUV2 • Enum 28: YUV3
On Screen Display	NAry	Mappings below are to the Usages on Monitor Enumerated Page `(0x81)` • Enum 0: None selected • Enum 1: OSD is disabled to appear • Enum 2: OSD is enabled to appear

Stereo Mode	NAry	Changing this value selects the video mode with respect to 2D or 3D. Mappings below are to the Usages on Monitor Enumerated Page (0x81) • Enum 0: None selected • Enum 1: Mono Mode • Enum 2: Enable Field-Sequential Right Eye First • Enum 3: Enable Field-Sequential Left Eye First • Enum 4: Enable 2-Way Interleaved Right Eye First • Enum 5: Enable 2-Way Interleaved Left Eye First • Enum 6: Enable 4-Way Interleaved, Display Stereo Buffer 0 (even scan lines) • Enum 7: Enable 4-Way Interleaved, Display Stereo Buffer 1 (odd scan lines) • Enum 8: Enable Side-by-Side Interleaved

29.3 Read-Only

Usage Name	Usage Type	Description
Auto Size Center	NAry	Mappings below are to the Usages on Monitor Enumerated Page (0x81) • Enum 0: None selected • Enum 1: Disabled • Enum 2: Enabled
Polarity Horizontal Synchronization	NAry	Mappings below are to the Usages on Monitor Enumerated Page (0x81) • Enum 0: None selected • Enum 1: Negative • Enum 2: Positive
Polarity Vertical Synchronization	NAry	Mappings below are to the Usages on Monitor Enumerated Page (0x81) • Enum 0: None selected • Enum 1: Negative • Enum 2: Positive
Synchronization Type	NAry	Mappings below are to the Usages on Monitor Enumerated Page (0x81) • Enum 0: None selected • Enum 1: Separate • Enum 2: Digital Composite • Enum 3: Composite on Green
Screen Orientation	NAry	Mappings below are to the Usages on Monitor Enumerated Page (0x81) • Enum 0: None selected • Enum 1: Landscape • Enum 2: Portrait
Horizontal Frequency	DV	Horizontal frequency in Hertz
Vertical Frequency	DV	Vertical frequency in 0.01 Hertz

29.4 Write-Only

Usage Name	Usage Type	Description
Degauss	DV	Writing a non-zero value to this control causes the monitor to start a self-timed degauss cycle. The monitor automatically completes the cycle without further action by the host. If a zero value (0) is written to this control, the monitor ignores the write and does not start a degauss cycle. The monitor does not alter any of its other control or status values in response to any write to this control.
Screen Orientation	NAry	This control saves or restores the settings of a monitor's virtual controls for the current video mode. The controls that are affected are implementation specific. Mappings below are to the Usages on Monitor Enumerated Page (0x81) • Enum 0: None selected • Enum 1: Store current settings • Enum 2: Restore factory default settings • Enum 3: Restore user-saved settings

30 Power Page (`0x84`)

Usage ID	Usage Name	Usage Types	Section
`00`	*Undefined*		
`01`	iName	SV	30.4
`02`	**Present Status**	CL	30.4
`03`	**Changed Status**	CL	30.4
`04`	**UPS**	CA	30.4
`05`	**Power Supply**	CA	30.4
`06-0F`	*Reserved*		
`10`	**Battery System**	CP	30.4
`11`	Battery System Id	SV	30.4
`12`	**Battery**	CP	30.4
`13`	Battery Id	SV	30.4
`14`	**Charger**	CP	30.4
`15`	Charger Id	SV	30.4
`16`	**Power Converter**	CP	30.4
`17`	Power Converter Id	SV	30.4
`18`	**Outlet System**	CP	30.4
`19`	Outlet System Id	SV	30.4
`1A`	**Input**	CP	30.4
`1B`	Input Id	SV	30.4
`1C`	**Output**	CP	30.4
`1D`	Output Id	SV	30.4
`1E`	**Flow**	CP	30.4
`1F`	Flow Id	SV	30.4
`20`	**Outlet**	CP	30.4
`21`	Outlet Id	SV	30.4
`22`	**Gang**	CL/CP	30.4
`23`	Gang Id	SV	30.4
`24`	**Power Summary**	CL/CP	30.4
`25`	Power Summary Id	SV	30.4
`26-2F`	*Reserved*		
`30`	Voltage	DV	30.5
`31`	Current	DV	30.5
`32`	Frequency	DV	30.5
`33`	Apparent Power	DV	30.5
`34`	Active Power	DV	30.5
`35`	Percent Load	DV	30.5
`36`	Temperature	DV	30.5
`37`	Humidity	DV	30.5
`38`	Bad Count	DV	30.5
`39-3F`	*Reserved*		

40	Config Voltage	SV/DV	30.6
41	Config Current	SV/DV	30.6
42	Config Frequency	SV/DV	30.6
43	Config Apparent Power	SV/DV	30.6
44	Config Active Power	SV/DV	30.6
45	Config Percent Load	SV/DV	30.6
46	Config Temperature	SV/DV	30.6
47	Config Humidity	SV/DV	30.6
48-4F	*Reserved*		
50	Switch On Control	DV	30.7
51	Switch Off Control	DV	30.7
52	Toggle Control	DV	30.7
53	Low Voltage Transfer	DV	30.7
54	High Voltage Transfer	DV	30.7
55	Delay Before Reboot	DV	30.7
56	Delay Before Startup	DV	30.7
57	Delay Before Shutdown	DV	30.7
58	Test	DV	30.7
59	Module Reset	DV	30.7
5A	Audible Alarm Control	DV	30.7
5B-5F	*Reserved*		
60	Present	DF	30.8
61	Good	DF	30.8
62	Internal Failure	DF	30.8
63	Voltag Out Of Range	DF	30.8
64	Frequency Out Of Range	DF	30.8
65	Overload	DF	30.8
66	Over Charged	DF	30.8
67	Over Temperature	DF	30.8
68	Shutdown Requested	DF	30.8
69	Shutdown Imminent	DF	30.8
6A-6A	*Reserved*		
6B	Switch On/Off	DF	30.8
6C	Switchable	DF	30.8
6D	Used	DF	30.8
6E	Boost	DF	30.8
6F	Buck	DF	30.8
70	Initialized	DF	30.8
71	Tested	DF	30.8
72	Awaiting Power	DF	30.8
73	Communication Lost	DF	30.8
74-FC	*Reserved*		
FD	iManufacturer	SV	30.9

FE	iProduct	SV	30.9
FF	iSerialNumber	SV	30.9
100-FFFF	*Reserved*		

Table 30.1: Power Page

30.1 Power and Battery Device Overview

A Power Device is a set of interconnected power modules (Battery Systems, Power Converters, Outlet Systems, and Power Summaries). Each module may include one or several interconnected sub-modules. Some submodules are located inside modules (Batteries, Chargers) and some are located at the interface of modules (Inputs, Outputs, and Outlets). All modules, sub-modules, and interconnections are defined as objects.

30.1.1 Battery

A Battery is typically a sealed pack of rechargeable electrochemical cells that provides a primary or auxiliary source of stored direct current (DC) energy to electronic devices. Some examples are the battery pack for cellular phones (principal source), the battery pack(s) for notebook computers (auxiliary source), and the sealed batteries in uninterruptible power supplies (auxiliary source).

Battery management may differ significantly for different Power Devices. It is therefore necessary to define three battery models, see Battery Settings

See Battery System Page (0x85) for Usages to comply with the Smart Battery Specification[1].

30.1.2 Charger

A Charger is typically a controlled converter (AC/DC or DC/DC) that charges batteries.

30.1.3 Input and Output

Inputs and Outputs are the connection points of a module with other modules. They are associated with dynamic data such as electric measurement and status. In addition to basic features such as Voltage, Current or Frequency, they may include controls such as 'Switch On Control' or 'Switch Off Control'.

30.1.4 Battery System

A Battery System (see Battery System Page (0x85)) is a collection of Batteries, Charger, Inputs, and Outputs. Battery Systems have intelligent switching systems that provide a solution for many of the complexities associated with the implementation of multiple-battery systems such as notebook computers.

30.1.5 Power Supply or Power Converter

A Power Supply or Power Converter is an electrical converter of source energy of a particular voltage, frequency, and current into a different specific voltage, frequency, and current. Typical supplies are AC to DC, DC to DC, DC to AC, AC to AC, and AC to DC to AC. Some examples are PC/notebook power supplies (AC to DC), battery chargers (AC to DC or DC to DC), and uninterruptible power supplies (AC to DC to AC). A Power Supply has Inputs and Outputs.

30.1.6 Outlet and Outlet System (or Power Source Node)

In its most general sense, an Outlet System is a set of physical connections by which devices requiring electrical energy are attached to a power source. The attachment point may be switched (capable of on/off control) or unswitched (incapable of on/off control). Of interest to the Power Device are outlets that are capable of being remotely switched. Examples are certain rackmount/enclosure-outlet receptacle strips and some uninterruptible power supplies. An Outlet is an individual switch and an Outlet System is a set of Outlets.

30.1.7 Gang

A Gang is a set of objects that have the same properties and act together. For example, a Gang of Outlets is composed of different Outlets that are connected to the same power source. If they are switchable, then they are switched by the same local or remote on/off control.

[1] http://sbs-forum.org/specs/sbdat110.pdf

30.1.8 Flow

The electric power Flows are an abstraction of power lines that power some Inputs (external to a module), are generated by some Outputs (a module to the external world), and may connect some Outputs to some Inputs (inter-module relation). Flow defines only the electric configuration of the power line.

30.1.9 Power Summary

The Power Summary is an abstraction that summarizes data from the power source that supplies the load of the Power Device. Its configuration is defined by an associated Flow. There is associated dynamic data defining the present power source (AC Input, Battery, etc.) of the Flow. Implemented in a Power Device that includes a battery, the Power Summary contains the same information as ACPI Battery Control Methods.

All of the data of the power source that supplies a particular load of a Power Device is distributed through different related modules. Without a Power Summary, an application would have to browse all of these modules in order to get the pertinent data. The Power Summary module therefore facilitates power management application design.

Power Management software (e.g., Microsoft OnNow) could use a Power Summary to associate a USB Node with its power source. Implementing only a Power Summary within a Power Device is the simplest way to expose characteristics of a power source to power management.

30.2 Object Definitions and Properties

An object is composed of a set of the following data items or collections of these data items:

- Controls: Manipulate present state or setting of the object.
- Settings: Factory settings.
- Status: Present or Changed status.
- Measures: Values related to Electrical or Power Devices.

Each object has an unique identifier (ID). The ID identifies the object inside a type. It is included in the static data of each object and used to define links between objects.

The object hierarchy of a Power Device is the following:

1. Battery Systems (zero to many), each having:
   - Inputs (zero to many), each being connected to an input Flow.
   - Chargers (one to many).
   - Batteries (one to many), each capable of being exclusively connected to a Charger or to an Output.
   - Outputs (one to many), each being connected to an output Flow.
2. Power Converters (zero to many), each having:
   - Inputs (one to many), each being connected to an output Flow and capable of being connected to any Output.
   - Outputs (one to many), each being connected to an input Flow and capable of being connected to any Input.
3. Outlet Systems (zero to many), each having:
   - Individual Outlets (1 to many), each being connected to an output Flow.
   - One input Flow.
   - Output Flow (one per Outlet).
   - Power Summary (zero to many), each being connected to an output Flow.

The sub-modules of a module are directly connected. For example, an Input is connected to a Charger inside a Battery System, or an Input is connected to an Output inside a Power Converter.

The different modules are connected to each other and to entities outside the Power Device by Flows. The connection points are the Inputs and the Outputs of the modules. For example, a Flow connects the outside world to an Input of a Battery System; it is the main AC Flow. Or, a Flow connects the Output of a Battery System to the Input of a Power Converter; it is the battery backup DC Input of the Converter.

The connection inside or outside a module could be static or dynamically controlled. For example, the connection of an Input to a Charger inside a Battery System is generally static. Or, the connection of an Input to an Outlet inside an Outlet System is generally dynamically controlled.

30.3 Power Device Examples

Power Devices can be implemented with one or more objects. The figures in this section illustrate how multiple objects can be contained in a single device.

The following legend defines the symbols used in these figures.

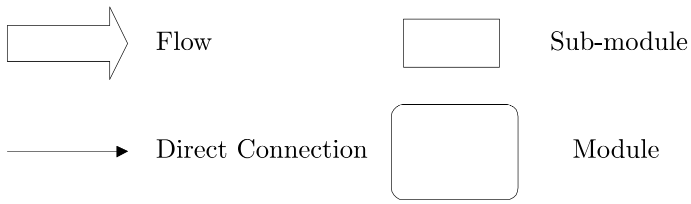


Figure 30.1: Legend for Power Device Configuration Figures

30.3.1 A Simple Power Supply

The following figure shows a Power Device configuration for a simple power supply.

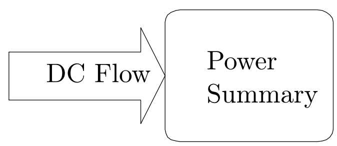


Figure 30.2: A Simple Power Supply

This configuration contains the following objects:

- One DC Output Flow (optional)
- One Power Summary

30.3.2 The Power Supply of a Typical USB Device

The following figure shows a Power Device configuration for the power supply of a typical USB device

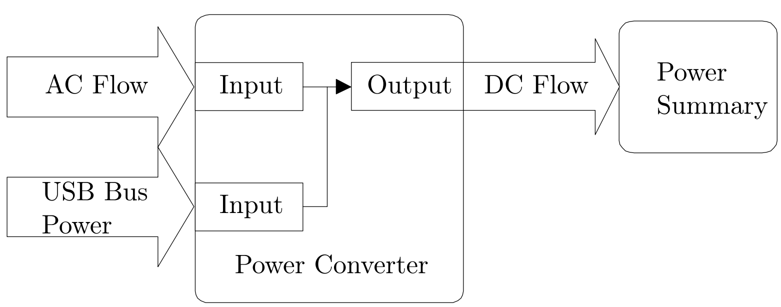


Figure 30.3: The Power Supply of a Typical USB Device

This configuration contains the following objects:

- One AC Input Flow, one DC Input Flow (USB Bus Power)
- One Power Converter consisting of one AC Input, one DC Input, and one DC Output
- One DC Output Flow
- One Power Summary

30.3.3 A Rackmount Receptacle Strip with Three Outlets

The following figure shows a Power Device configuration for a rackmount receptacle strip with three outlets.

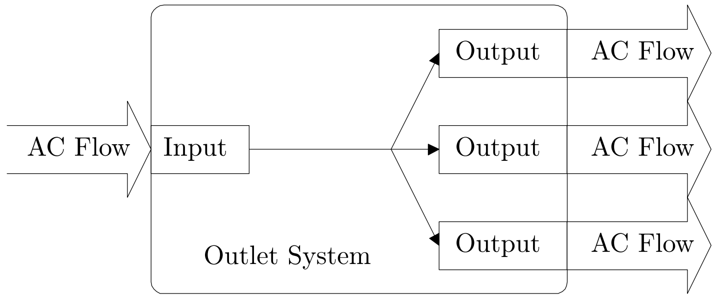


Figure 30.4: A Rackmount Receptacle Strip with Three Outlets

This configuration contains the following objects:

- One AC Input Flow
- One Outlet System consisting of one AC Input and three individual AC Outlets
- Three AC Output Flows

30.3.4 A Simple UPS with One Non-Switchable Output

The following figure shows a Power Device configuration for a simple UPS with one non-switchable output.

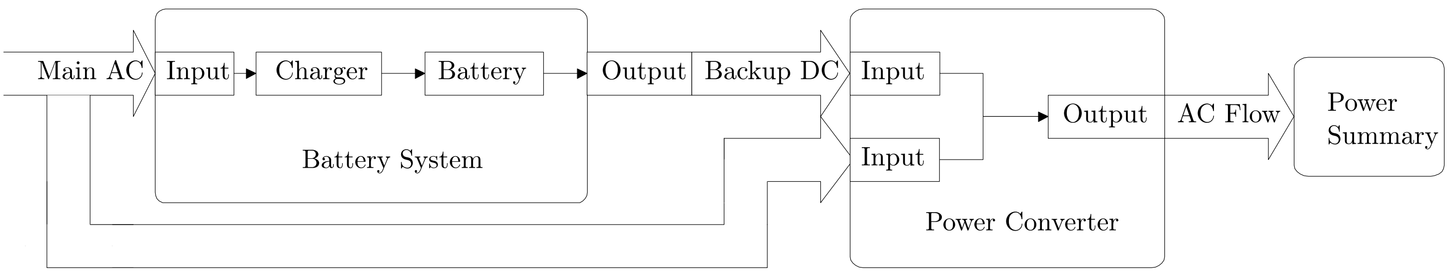


Figure 30.5: A Simple UPS with One Non-Switchable Output

This configuration contains the following objects:

- One AC Input Flow (Main AC)
- One Battery System consisting of one AC Input, one Battery, one Charger, and one DC Output
- One DC Flow (Backup DC)
- One Power Converter consisting of one DC Input, one AC Input and one AC Output
- One AC Output Flow (AC Flow)
- One Power Summary

30.3.5 A UPS with One Non-Switchable Output and Two Switchable Outlets

The following figure shows a Power Device configuration for a UPS with one non-switchable output and two switchable outlets.

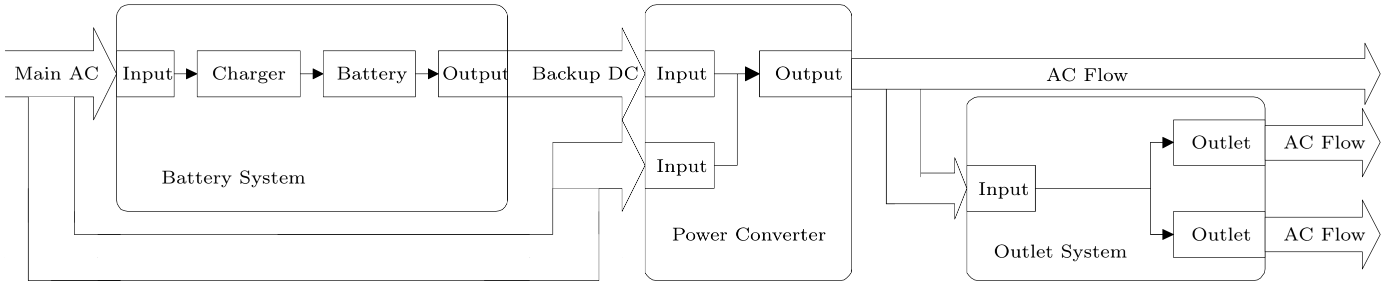


Figure 30.6: A UPS with One Non-Switchable Output and Two Switchable Outlets

This configuration contains the following objects:

- One AC Input Flow (Main AC)
- One Battery System consisting of one AC Input, one Battery, one Charger), and one DC Output
- One DC Flow (Backup DC)
- One Power Converter consisting of one DC Input, one AC Input, and one AC Output
- One AC Output Flow (AC Flow)
- One Outlet System with two outlets
- Two AC Output Flows (AC Flow)

30.4 Power Devices

Usage Name	Usage Type	Description
iName	SV	Index of a string descriptor containing the physical description of the object
Present Status	CL	Present status information related to an object
Changed Status	CL	
UPS	CA	Defines an Uninterruptible Power Supply
Power Supply	CA	Defines a Power Supply
Battery System	CP	Defines a Battery System power module
Battery System Id	SV	Indicates a particular Battery System
Battery	CP	Defines a Battery
Battery Id	SV	Indicates a particular Battery
Charger	CP	Defines a Charger
Charger Id	SV	Indicates a particular Charger
Power Converter	CP	Defines a Power Converter power module
Power Converter Id	SV	Indicates a particular Power Converter
Outlet System	CP	Defines an Outlet System power module
Outlet System Id	SV	Indicates a particular Outlet System
Input	CP	Defines an Input
Input Id	SV	Indicates a particular Input
Output	CP	Defines an Output
Output Id	SV	Indicates a particular Output
Flow	CP	Defines a Flow
Flow Id	SV	Indicate a particular Flow
Outlet	CP	Defines an Outlet
Outlet Id	SV	Indicate a particular Outlet
Gang	CL/CP	Defines a Gang
Gang Id	SV	Indicates a particular Gang
Power Summary	CL/CP	Defines a Power Summary
Power Summary Id	SV	Indicates a particular Power Summary

30.5 Power Measures

Usage Name	Usage Type	Description
Voltage	DV	Actual value of the voltage. (Default units in Volts)
Current	DV	Actual value of the current. (Default units in Amps)
Frequency	DV	Actual value of the frequency. (Default units in Hertz)
Apparent Power	DV	Actual value of the apparent power (Default units in Volt-Amps)
Active Power	DV	Actual value of the active (RMS) power (Default units in Watts)
Percent Load	DV	The actual value of the percentage of the power capacity presently being used on this input or output line, i.e., the greater of the percent load of true power capacity and the percent load of Apparent Power.
Temperature	DV	The actual value of the temperature. (Default units in degrees Kelvin)
Humidity	DV	The actual value of the humidity (Default unit is %)
Bad Count	DV	The number of times the device, module, or sub-module entered a bad condition (e.g., an AC Input entered an out-of-tolerance condition).

30.6 Power Configuration

Usage Name	Usage Type	Description
Config Voltage	SV/DV	Nominal value of the voltage. (Default units in Volts)
Config Current	SV/DV	Nominal value of the current. (Default units in Amps)
Config Frequency	SV/DV	Nominal value of the frequency. (Default units in Hertz)
Config Apparent Power	SV/DV	Nominal value of the apparent power (Default units in Volt-Amps)
Config Active Power	SV/DV	Nominal value of the active (RMS) power (Default units in Watts)
Config Percent Load	SV/DV	Nominal value of the percentage load that could be used without critical overload
Config Temperature	SV/DV	Nominal value of the temperature. (Default units in 0.1 degrees Kelvin)
Config Humidity	SV/DV	Nominal value of the humidity (Default unit is %)

30.7 Power Control

Usage Name	Usage Type	Description
Switch On Control	DV	Controls the Switch On sequence. Write Value: • 0 : **Stop Sequence** • 1 : **Start Sequence** Read Value: • 0 : **None** • 1 : **Started** • 2 : **In Progress** • 3 : **Completed**
Switch Off Control	DV	Controls the Switch Off sequence. Write Value: • 0 : **Stop Sequence** • 1 : **Start Sequence** Read Value: • 0 : **None** • 1 : **Started** • 2 : **In Progress** • 3 : **Completed**
Toggle Control	DV	Controls the Toggle sequence. A Toggle sequence is a Switch Off sequence followed immediately by a Switch On sequence. Write Value: • 0 : **Stop Sequence** • 1 : **Start Sequence** Read Value: • 0 : **None** • 1 : **Started** • 2 : **In Progress** • 3 : **Completed**
Low Voltage Transfer	DV	The minimum line voltage allowed before the PS system transfers to battery backup. (Default units in RMS Volts)
High Voltage Transfer	DV	The maximum line voltage allowed before the PS system transfers to battery backup. (Default units in RMS Volts)
Delay Before Reboot	DV	Writing this value immediately shuts down (i.e., turns off) the output for a period equal to the indicated number of seconds, after which time the output is started. If the number of seconds required to perform the request is greater than the requested duration, then the requested shutdown and startup cycle shall be performed in the minimum time possible, but in no case shall this require more than the requested duration plus 60 seconds. If the startup should occur during a utility failure, the startup shall not occur until the utility power is restored. When read, returns the number of seconds remaining in the countdown, or –1 if no countdown is in progress.

Delay Before Startup	DV	Writing this value starts the output after the indicated number of seconds. Sending this command with 0 causes the startup to occur immediately. Sending this command with –1 aborts the countdown. If the output is already on, at the time the countdown reaches 0, nothing happens. On some systems, if the driver on the device side is restarted while a startup countdown is in effect, the countdown is aborted. If the countdown expires during a utility failure, the startup shall not occur until the utility power is restored. Writing this value overrides the effect of any 'Delay Before Startup' countdown or 'Delay Before Reboot' countdown in progress. When read, returns the number of seconds remaining in the countdown, or –1 if no countdown is in progress.
Delay Before Shutdown	DV	Writing this value shuts down (i.e., turns off) either the output after the indicated number of seconds, or sooner if the batteries become depleted. Sending this command with 0 causes the shutdown to occur immediately. Sending this command with –1 aborts the countdown. If the system is already in the desired state at the time the countdown reaches 0, there is no additional action (i.e. there is no additional action if the output is already off). On some systems, if the driver on the device side is restarted while a shutdown countdown is in effect, the countdown may be aborted. Writing this value overrides any countdown already in effect. When read, will return the number of seconds remaining until shutdown, or –1 if no shutdown countdown is in effect.
Test	DV	Test request/result value. Write Value: • 0 : **No test** • 1 : **Quick test** • 2 : **Deep test** • 3 : **Abort test** Read Value: • 1 : **Done and Passed** • 2 : **Done and Warning** • 3 : **Done and Error** • 4 : **Aborted** • 5 : **In progress** • 6 : **No test initiated**
Module Reset	DV	Module Reset request value Write Value: • 0 : **No Reset** • 1 : **Reset Module** • 2 : **Reset Module's Alarms** • 3 : **Reset Module's Counters** Read Value: Module Reset result value

Audible Alarm Control	DV	Read or Write Value: • 1 : **Disabled (Never sound)** • 2 : **Enabled (Sound when an alarm is present)** • 3 : **Muted (Temporarily silence the alarm)** This is the requested state (Write value) or the present state (Read value) of the audible alarm. The Muted state (3) persists until the alarm would normally stop sounding. At the end of this period the value reverts to Enabled (2). Writing the value Muted (3) when the audible alarm is not sounding is accepted but otherwise has no effect.

30.8 Power Generic Status

Usage Name	Usage Type	Description
Present	DF	Present (1)/Not Present (0)
Good	DF	Good (1)/Bad (0)
Internal Failure	DF	Failed (1)/Not Failed (0)
Voltage Out Of Range	DF	Out Of Range (1)/In Range (0)
Frequency Out Of Range	DF	Out Of Range (1)/In Range (0)
Overload	DF	Overloaded (1)/Not Overloaded (0)
Over Charged	DF	Overcharged (1)/Not Overcharged (0)
Over Temperature	DF	Over Temperature (1)/Not Over Temperature (0)
Shutdown Requested	DF	Requested (1)/Not Requested (0)
Shutdown Imminent	DF	Imminent (1)/Not Imminent (0)
Switch On/Off	DF	On (1) indicates the switch is closed. Off (0) indicates the switch is opened. The status could be On (1) but the load still not powered if the input source power is not present. The controls associated with this status could be used to connect or disconnect Input or Output from Flow or any module or sub-module.
Switchable	DF	Switchable (1)/Not Switchable (0)
Used	DF	Used (1)/Unused (0) The status indicates this Input is presently used in the module (e.g., the Power Converter converts or transfers this Input into Output(s)).
Boost	DF	Boosted (1)/Not Boosted (0) The status indicates this Input is used in the module but voltage is increased to fit within nominal range values.
Buck	DF	Bucked (1)/Not Bucked (0) The status indicates this Input is used in the module but voltage is reduced to fit with nominal range values.
Initialized	DF	Initialized (1)/Not Initialized (0)
Tested	DF	Tested (1)/Not Tested (0)
Awaiting Power	DF	Awaiting Power (1)/Not Awaiting Power (0) The status indicates that the device, module, or sub-module is awaiting power from any available input source.

Communication Lost	DF	Communication is lost (1)/Communication is not lost (0) The status indicates that the USB agent of the device, module, or sub-module is not able to communicate with the corresponding control part of the device, module, or sub-module. As a consequence, all of the related data are no longer reliable and will not be updated until communication is reestablished.

30.9 Power Device Identification

Usage Name	Usage Type	Description
iManufacturer	SV	Index of a string descriptor describing the manufacturer
iProduct	SV	Index of a string descriptor describing the product
iSerialNumber	SV	Index of a string descriptor describing the device's serial number

31 Battery System Page (0x85)

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Smart Battery Battery Mode**	CL	31.2
02	**Smart Battery Battery Status**	NAry	31.3.1
03	**Smart Battery Alarm Warning**	NAry	31.3.2
04	**Smart Battery Charger Mode**	CL	31.6
05	**Smart Battery Charger Status**	CL	31.7
06	**Smart Battery Charger Spec Info**	CL	31.8
07	**Smart Battery Selector State**	CL	31.1.1
08	**Smart Battery Selector Presets**	CL	31.1.2
09	**Smart Battery Selector Info**	CL	31.1.3
0A-0F	*Reserved*		
10	Optional Mfg Function 1	DV	31.1
11	Optional Mfg Function 2	DV	31.1
12	Optional Mfg Function 3	DV	31.1
13	Optional Mfg Function 4	DV	31.1
14	Optional Mfg Function 5	DV	31.1
15	Connection To SM Bus	DF	31.1.1
16	Output Connection	DF	31.1.1
17	Charger Connection	DF	31.1.1
18	Battery Insertion	DF	31.1.1
19	Use Next	DF	31.1.2
1A	OK To Use	DF	31.1.2
1B	Battery Supported	DF	31.1.3
1C	Selector Revision	DF	31.1.3
1D	Charging Indicator	DF	31.1.3
1E-27	*Reserved*		
28	Manufacturer Access	DV	31.2
29	Remaining Capacity Limit	DV	31.2
2A	Remaining Time Limit	DV	31.2
2B	At Rate	DV	31.2
2C	Capacity Mode	DV	31.2
2D	Broadcast To Charger	DV	31.2
2E	Primary Battery	DV	31.2
2F	Charge Controller	DV	31.2
30-3F	*Reserved*		
40	Terminate Charge	Sel	31.3.2
41	Terminate Discharge	Sel	31.3.2
42	Below Remaining Capacity Limit	Sel	31.3.2
43	Remaining Time Limit Expired	Sel	31.3.2

44	Charging	Sel	31.3.1
45	Discharging	Sel	31.3.1
46	Fully Charged	Sel	31.3.1
47	Fully Discharged	Sel	31.3.1
48	Conditioning Flag	DF	31.3
49	At Rate OK	DF	31.3
4A	Smart Battery Error Code	DV	31.3
4B	Need Replacement	DF	31.3
4C-5F	*Reserved*		
60	At Rate Time To Full	DV	31.4
61	At Rate Time To Empty	DV	31.4
62	Average Current	DV	31.4
63	Max Error	DV	31.4
64	Relative State Of Charge	DV	31.4
65	Absolute State Of Charge	DV	31.4
66	Remaining Capacity	DV	31.4
67	Full Charge Capacity	DV	31.4
68	Run Time To Empty	DV	31.4
69	Average Time To Empty	DV	31.4
6A	Average Time To Full	DV	31.4
6B	Cycle Count	DV	31.4
6C-7F	*Reserved*		
80	Battery Pack Model Level	SV	31.5
81	Internal Charge Controller	SF	31.5
82	Primary Battery Support	SF	31.5
83	Design Capacity	SV	31.5
84	Specification Info	SV	31.5
85	Manufacture Date	SV	31.5
86	Serial Number	SV	31.5
87	iManufacturer Name	SV	31.5
88	iDevice Name	SV	31.5
89	iDevice Chemistry	SV	31.5
8A	Manufacturer Data	SV	31.5
8B	Rechargable	SV	31.5
8C	Warning Capacity Limit	SV	31.5
8D	Capacity Granularity 1	SV	31.5
8E	Capacity Granularity 2	SV	31.5
8F	iOEM Information	SV	31.5
90-BF	*Reserved*		
C0	Inhibit Charge	DF	31.6
C1	Enable Polling	DF	31.6
C2	Reset To Zero	DF	31.6
C3-CF	*Reserved*		

D0	AC Present	DV	31.7
D1	Battery Present	DV	31.7
D2	Power Fail	DV	31.7
D3	Alarm Inhibited	DV	31.7
D4	Thermistor Under Range	DV	31.7
D5	Thermistor Hot	DV	31.7
D6	Thermistor Cold	DV	31.7
D7	Thermistor Over Range	DV	31.7
D8	Voltage Out Of Range	DV	31.7
D9	Current Out Of Range	DV	31.7
DA	Current Not Regulated	DV	31.7
DB	Voltage Not Regulated	DV	31.7
DC	Master Mode	DV	31.7
DD-EF	*Reserved*		
F0	Charger Selector Support	SF	31.8
F1	Charger Spec	SV	31.8
F2	Level 2	SF	31.8
F3	Level 3	SF	31.8
F4-FFFF	*Reserved*		

Table 31.1: Battery System Page

31.1 Battery System Settings and Controls

Usage Name	Usage Type	Description
Optional Mfg Function 1	DV	Manufacturer-specific function
Optional Mfg Function 2	DV	Manufacturer-specific function
Optional Mfg Function 3	DV	Manufacturer-specific function
Optional Mfg Function 4	DV	Manufacturer-specific function
Optional Mfg Function 5	DV	Manufacturer-specific function

31.1.1 Selector State

Usage Name	Usage Type	Description
Smart Battery Selector State	CL	
Connection To SM Bus	DF	State of connection to the system SMBus
Output Connection	DF	Id of the connected Output to the specified battery
Charger Connection	DF	Id of the specified Charger to the specified Battery
Battery Insertion	DF	Insertion status of the specified Battery into the system

31.1.2 Selector Presets

Usage Name	Usage Type	Description
Smart Battery Selector Presets	CL	
Use Next	DF	Whether or not this Battery will be used for next discharge
OK To Use	DF	Whether or not this Battery is usable

31.1.3 Selector Info

Usage Name	Usage Type	Description
Smart Battery Selector Info	CL	
Battery Supported	DF	Whether or not this Battery is supported by the selector
Selector Revision	DF	Version of the Smart Battery Selector specification. For revision 1.0, the value will be 001
Charging Indicator	DF	Indicates whether the selector reports the charger's status in the POWERBY nibble of SelectorState

31.2 Battery Controls

Usage Name	Usage Type	Description
Smart Battery Battery Mode	CL	
Manufacturer Access	DV	Meaning is according to the Smart Battery Data Specification[1]
Remaining Capacity Limit	DV	Sets the value of the battery's remaining capacity, which causes a Remaining Capacity alarm to be sent. Whenever the battery's remaining capacity falls below the value in the RemainingCapacity alarm register, the battery periodically issues a RemainingCapacity alarm. (Units are defined by CapacityMode.)
Remaining Time Limit	DV	Sets the value of the battery's remaining time, which causes the RemainingTimeLimit control to be activated. Whenever the battery's remaining time falls below the value in the RemainingTimeLimit register, the battery periodically issues a RemainingTimeLimitExpired alarm. (Units are seconds.)
At Rate	DV	Sets the value used by the battery to calculate 'At Rate Time To Full', 'At Rate Time To Empty' or 'AT Rate OK'. ('At Rate' units are defined by 'Capacity Mode'.)
Capacity Mode	DV	Battery capacity units are as follows: • 0: maH, (used in SMB) • 1: mwH (used in SMB) • 2: % • 3: Boolean support only (OK or failed)
Broadcast To Charger	DV	Enables or disables broadcast to charger
Primary Battery	DV	Whether operating in primary or secondary mode
Charge Controller	DV	Whether internal charge control is enabled

[1] http://sbs-forum.org/specs/sbdat110.pdf

31.3 Battery Status

Usage Name	Usage Type	Description
Conditioning Flag	DF	Whether conditioning cycle needed (else Battery is OK)
At Rate OK	DF	After an AtRate value setting, the device sets AtRateOK to 0 and calculates the AtRateTimeToFull and AtRateToEmpty values. When these values are already available, the device sets AtRateOK to 1.
Smart Battery Error Code	DV	An Smart Battery-specific 4-bit error code
Need Replacement	DF	Whether the battery needs replacement

31.3.1 Status

Usage Name	Usage Type	Description
Smart Battery Battery Status	NAry	
Charging	Sel	Battery is charging
Discharging	Sel	Battery is discharing
Fully Charged	Sel	Battery is fully-charged
Fully Discharged	Sel	Battery is fully discharged

31.3.2 Alarm

Usage Name	Usage Type	Description
Smart Battery Alarm Warning	NAry	
Terminate Charge	Sel	Terminates charge
Terminate Discharge	Sel	Terminates discharge
Below Remaining Capacity Limit	Sel	Is below
Remaining Time Limit Expired	Sel	Has expired

31.4 Battery Measures

Usage Name	Usage Type	Description
At Rate Time To Full	DV	The predicted remaining time to fully charge the battery at the AtRate value. (Units are minutes.)
At Rate Time To Empty	DV	The predicted operating time if the battery is discharged at the AtRate value.
Average Current	DV	A one-minute rolling average of the current being supplied or accepted through the battery terminals
Max Error	DV	The expected margin error (%) in the state of charge calculation
Relative State Of Charge	DV	The predicted remaining battery capacity expressed as a percentage of the last measured full charge capacity. (Units are %.)
Absolute State Of Charge	DV	The predicted remaining battery capacity expressed as a percentage of design capacity. (Units are %. The value may be greater than 100%.)
Remaining Capacity	DV	The predicted remaining capacity. (See CapacityMode for units.)
Full Charge Capacity	DV	The predicted pack capacity when it is fully charged. (See CapacityMode for units.)
Run Time To Empty	DV	The predicted remaining battery life, in minutes, at the present rate of discharge. The RunTimeToEmpty is calculated based on either current or power depending on the CapacityMode setting
Average Time To Empty	DV	A one-minute rolling average, in minutes, of the predicted remaining battery time life. The AverageTimeToEmpty is calculated based on either current or power depending on the CapacityMode setting
Average Time To Full	DV	A one-minute rolling average, in minutes, of the predicted remaining time until the battery reaches full charge
Cycle Count	DV	The number, in cycles, of charge/discharge cycles the battery has experienced.

31.5 Battery Settings

Usage Name	Usage Type	Description
Battery Pack Model Level	SV	Battery model level for the battery pack: • 0: Basic Model • 1: Intelligent Model • 2: Smart Battery
Internal Charge Controller	SF	Whether charge controller function supported in the battery pack
Primary Battery Support	SF	Whether Primary battery function supported in the battery pack
Design Capacity	SV	The theoretical capacity of a new pack. (See CapacityMode for units.)
Specification Info	SV	The version number of the Smart Battery Data Specification[2].
Manufacture Date	SV	The date the pack was manufactured in a packed integer. The date is packed in the following fashion: (year − 1980)*512 + month*32 + day
Serial Number	SV	The cell pack serial number
iManufacturer Name	SV	Index of a string descriptor containing the battery manufacturer's name
iDevice Name	SV	Index of a string descriptor containing the battery's name
iDevice Chemistry	SV	Index of a string descriptor containing the battery's chemistry
Manufacturer Data	SV	A binary data block containing manufacturer specific data
Rechargable	SV	Whether the battery is rechargable
Warning Capacity Limit	SV	OEM-designed battery warning capacity. (Units are defined by CapacityMode.)
Capacity Granularity 1	SV	Battery capacity granularity between low and warning. (Units are defined by CapacityMode.)
Capacity Granularity 2	SV	Battery capacity granularity between warning and full. (Units are defined by CapacityMode)
iOEM Information	SV	Index of a string descriptor defining OEM specific information for the battery

[2] http://sbs-forum.org/specs/sbdat110.pdf

31.6 Charger Controls

Usage Name	Usage Type	Description
Smart Battery Charger Mode	CL	
Inhibit Charge	DF	Inhibit or enable charging
Enable Polling	DF	Enable or disable polling
Reset To Zero	DF	Reset Charging Current and Voltage values to zero

31.7 Charger Status

Usage Name	Usage Type	Description
Smart Battery Charger Status	CL	
AC Present	DF	Present/Not Present
Battery Present	DF	Present/Not Present
Power Fail	DF	Low/Not Low
Alarm Inhibited	DF	Inhibited/Not Inhibited
Thermistor Under Range	DF	Under/Not Under
Thermistor Hot	DF	Hot/Not Hot
Thermistor Cold	DF	Cold/ Not Cold
Thermistor Over Range	DF	Over/Not Over
Voltage Out Of Range	DF	Not Valid/Valid
Current Out Of Range	DF	Not Valid/Valid
Current Not Regulated	DF	Not Regulated/Regulated
Voltage Not Regulated	DF	Not Regulated/Regulated
Master Mode	DF	Master Mode (polling is enabled) / Slave Mode (polling is disabled)

31.8 Charger Settings

Usage Name	Usage Type	Description
Smart Battery Charger Spec Info	CL	
Charger Selector Support	SF	Yes/No
Charger Spec	SV	Specification reference. (0001 for SMB charger 1.0)
Level 2	SF	Charger at level 2. (Level 1 default))
Level 3	SF	Charger at level 3. (Level 1 default)

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Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Barcode Badge Reader**	CA	32.1
02	**Barcode Scanner**	CA	32.1
03	**Dumb Bar Code Scanner**	CA	32.1
04	**Cordless Scanner Base**	CA	32.1
05	**Bar Code Scanner Cradle**	CA	32.1
06-0F	*Reserved*		
10	**Attribute Report**	CL	32.2
11	**Settings Report**	CL	32.2
12	**Scanned Data Report**	CL	32.2
13	**Raw Scanned Data Report**	CL	32.2
14	**Trigger Report**	CL	32.2
15	**Status Report**	CL	32.2
16	**UPC/EAN Control Report**	CL	32.2
17	**EAN 2/3 Label Control Report**	CL	32.2
18	**Code 39 Control Report**	CL	32.2
19	**Interleaved 2 of 5 Control Report**	CL	32.2
1A	**Standard 2 of 5 Control Report**	CL	32.2
1B	**MSI Plessey Control Report**	CL	32.2
1C	**Codabar Control Report**	CL	32.2
1D	**Code 128 Control Report**	CL	32.2
1E	**Misc 1D Control Report**	CL	32.2
1F	**2D Control Report**	CL	32.2
20-2F	*Reserved*		
30	Aiming/Pointer Mode	SF	32.3
31	Bar Code Present Sensor	SF	32.3
32	Class 1A Laser	SF	32.3
33	Class 2 Laser	SF	32.3
34	Heater Present	SF	32.3
35	Contact Scanner	SF	32.3
36	Electronic Article Surveillance Notification	SF	32.3
37	Constant Electronic Article Surveillance	SF	32.3
38	Error Indication	SF	32.3
39	Fixed Beeper	SF	32.3
3A	Good Decode Indication	SF	32.3
3B	Hands Free Scanning	SF	32.3
3C	Intrinsically Safe	SF	32.3
3D	Klasse Eins Laser	SF	32.3
3E	Long Range Scanner	SF	32.3
3F	Mirror Speed Control	SF	32.3

40	Not On File Indication	SF	32.3
41	Programmable Beeper	SF	32.3
42	Triggerless	SF	32.3
43	Wand	SF	32.3
44	Water Resistant	SF	32.3
45	Multi-Range Scanner	SF	32.3
46	Proximity Sensor	SF	32.3
47-4C	*Reserved*		
4D	Fragment Decoding	DF	32.4
4E	Scanner Read Confidence	DV	32.4
4F	**Data Prefix**	NAry	32.5
50	Prefix AIMI	Sel	32.5
51	Prefix None	Sel	32.5
52	Prefix Proprietary	Sel	32.5
53-54	*Reserved*		
55	Active Time	DV	32.6
56	Aiming Laser Pattern	DF	32.6
57	Bar Code Present	OOC	32.6
58	Beeper State	OOC	32.6
59	Laser On Time	DV	32.6
5A	Laser State	OOC	32.6
5B	Lockout Time	DV	32.6
5C	Motor State	OOC	32.6
5D	Motor Timeout	DV	32.6
5E	Power On Reset Scanner	DF	32.6
5F	Prevent Read of Barcodes	DF	32.6
60	Initiate Barcode Read	DF	32.6
61	Trigger State	OOC	32.6
62	**Trigger Mode**	NAry	32.6.1
63	Trigger Mode Blinking Laser On	Sel	32.6.1
64	Trigger Mode Continuous Laser On	Sel	32.6.1
65	Trigger Mode Laser on while Pulled	Sel	32.6.1
66	Trigger Mode Laser stays on after release	Sel	32.6.1
67-6C	*Reserved*		
6D	Commit Parameters to NVM	DF	32.7
6E	Parameter Scanning	DF	32.7
6F	Parameters Changed	OOC	32.7
70	Set parameter default values	DF	32.7
71-74	*Reserved*		
75	Scanner In Cradle	OOC	32.8
76	Scanner In Range	OOC	32.8
77-79	*Reserved*		
7A	Aim Duration	DV	32.9
7B	Good Read Lamp Duration	DV	32.9

7C	Good Read Lamp Intensity	DV	32.9
7D	Good Read LED	DF	32.9
7E	Good Read Tone Frequency	DV	32.9
7F	Good Read Tone Length	DV	32.9
80	Good Read Tone Volume	DV	32.9
81-81	*Reserved*		
82	No Read Message	DF	32.9
83	Not on File Volume	DV	32.9
84	Powerup Beep	DF	32.9
85	Sound Error Beep	DF	32.9
86	Sound Good Read Beep	DF	32.9
87	Sound Not On File Beep	DF	32.9
88	**Good Read When to Write**	NAry	32.9.1
89	GRWTI After Decode	Sel	32.9.1
8A	GRWTI Beep/Lamp after transmit	Sel	32.9.1
8B	GRWTI No Beep/Lamp use at all	Sel	32.9.1
8C-90	*Reserved*		
91	Bookland EAN	DF	32.10
92	Convert EAN 8 to 13 Type	DF	32.10
93	Convert UPC A to EAN-13	DF	32.10
94	Convert UPC-E to A	DF	32.10
95	EAN-13	DF	32.10
96	EAN-8	DF	32.10
97	EAN-99 128 Mandatory	DF	32.10
98	EAN-99 P5/128 Optional	DF	32.10
99	Enable EAN Two Label	DF	32.10
9A	UPC/EAN	DF	32.10
9B	UPC/EAN Coupon Code	DF	32.10
9C	UPC/EAN Periodicals	DV	32.10
9D	UPC-A	DF	32.10
9E	UPC-A with 128 Mandatory	DF	32.10
9F	UPC-A with 128 Optional	DF	32.10
A0	UPC-A with P5 Optional	DF	32.10
A1	UPC-E	DF	32.10
A2	UPC-E1	DF	32.10
A3-A8	*Reserved*		
A9	**Periodical**	NAry	32.10.1
AA	Periodical Auto-Discriminate +2	Sel	32.10.1
AB	Periodical Only Decode with +2	Sel	32.10.1
AC	Periodical Ignore +2	Sel	32.10.1
AD	Periodical Auto-Discriminate +5	Sel	32.10.1
AE	Periodical Only Decode with +5	Sel	32.10.1
AF	Periodical Ignore +5	Sel	32.10.1

B0	**Check**	NAry	32.10.2
B1	Check Disable Price	Sel	32.10.2
B2	Check Enable 4 digit Price	Sel	32.10.2
B3	Check Enable 5 digit Price	Sel	32.10.2
B4	Check Enable European 4 digit Price	Sel	32.10.2
B5	Check Enable European 5 digit Price	Sel	32.10.2
B6-B6	*Reserved*		
B7	EAN Two Label	DF	32.11
B8	EAN Three Label	DF	32.11
B9	EAN 8 Flag Digit 1	DV	32.11
BA	EAN 8 Flag Digit 2	DV	32.11
BB	EAN 8 Flag Digit 3	DV	32.11
BC	EAN 13 Flag Digit 1	DV	32.11
BD	EAN 13 Flag Digit 2	DV	32.11
BE	EAN 13 Flag Digit 3	DV	32.11
BF	Add EAN 2/3 Label Definition	DF	32.11
C0	Clear all EAN 2/3 Label Definitions	DF	32.11
C1-C2	*Reserved*		
C3	Codabar	DF	32.12
C4	Code 128	DF	32.12
C5-C6	*Reserved*		
C7	Code 39	DF	32.12
C8	Code 93	DF	32.12
C9	Full ASCII Conversion	DF	32.12
CA	Interleaved 2 of 5	DF	32.12
CB	Italian Pharmacy Code	DF	32.12
CC	MSI/Plessey	DF	32.12
CD	Standard 2 of 5 IATA	DF	32.12
CE	Standard 2 of 5	DF	32.12
CF-D2	*Reserved*		
D3	Transmit Start/Stop	DF	32.12
D4	Tri-Optic	DF	32.12
D5	UCC/EAN-128	DF	32.12
D6	**Check Digit**	NAry	32.12.1
D7	Check Digit Disable	Sel	32.12.1
D8	Check Digit Enable Interleaved 2 of 5 OPCC	Sel	32.12.1
D9	Check Digit Enable Interleaved 2 of 5 USS	Sel	32.12.1
DA	Check Digit Enable Standard 2 of 5 OPCC	Sel	32.12.1
DB	Check Digit Enable Standard 2 of 5 USS	Sel	32.12.1
DC	Check Digit Enable One MSI Plessey	Sel	32.12.1
DD	Check Digit Enable Two MSI Plessey	Sel	32.12.1
DE	Check Digit Codabar Enable	Sel	32.12.1

DF	Check Digit Code 39 Enable	Sel	32.12.1
E0-EF	*Reserved*		
F0	**Transmit Check Digit**	NAry	32.12.2
F1	Disable Check Digit Transmit	Sel	32.12.2
F2	Enable Check Digit Transmit	Sel	32.12.2
F3-FA	*Reserved*		
FB	Symbology Identifier 1	DV	32.13
FC	Symbology Identifier 2	DV	32.13
FD	Symbology Identifier 3	DV	32.13
FE	Decoded Data	DV	32.13
FF	Decode Data Continued	DF	32.13
100	Bar Space Data	DV	32.13
101	Scanner Data Accuracy	DV	32.13
102	**Raw Data Polarity**	NAry	32.14
103	Polarity Inverted Bar Code	Sel	32.14
104	Polarity Normal Bar Code	Sel	32.14
105-105	*Reserved*		
106	Minimum Length to Decode	DV	32.15
107	Maximum Length to Decode	DV	32.15
108	Discrete Length to Decode 1	DV	32.15
109	Discrete Length to Decode 2	DV	32.15
10A	**Data Length Method**	NAry	32.15.1
10B	DL Method Read any	Sel	32.15.1
10C	DL Method Check in Range	Sel	32.15.1
10D	DL Method Check for Discrete	Sel	32.15.1
10E-10F	*Reserved*		
110	Aztec Code	DF	32.16
111	BC412	DF	32.12
112	Channel Code	DF	32.16
113	Code 16	DF	32.16
114	Code 32	DF	32.16
115	Code 49	DF	32.16
116	Code One	DF	32.16
117	Colorcode	DF	32.16
118	Data Matrix	DF	32.16
119	MaxiCode	DF	32.16
11A	MicroPDF	DF	32.16
11B	PDF-417	DF	32.16
11C	PosiCode	DF	32.16
11D	QR Code	DF	32.16
11E	SuperCode	DF	32.16
11F	UltraCode	DF	32.16
120	USD-5 (Slug Code)	DF	32.16
121	VeriCode	DF	32.16

122-FFFF	*Reserved*		

Table 32.1: Barcode Scanner

32.1 Barcode Scanner Devices

Primary types of scanner configurations.

Usage Name	Usage Type	Description
Barcode Badge Reader	CA	A Wall Mounted, swipe activated device that reads barcodes on ID badges
Barcode Scanner	CA	A device that reads barcodes and transmits decoded data
Dumb Bar Code Scanner	CA	A device that reads barcodes and transmits raw barcode data without decoding the barcode
Cordless Scanner Base	CA	A device that communicates with a barcode scanner that is not connected with a cable (includes IR and Radio connections)
Bar Code Scanner Cradle	CA	A device that receives stored barcode data when the scanner is placed in a cradle

32.2 Report Collections

Usage Name	Usage Type	Description
Attribute Report	CL	A Feature report that the Bar Code Scanner uses to specify the scanner's attributes
Settings Report	CL	An Output report that the USB Host uses to set the scanner's nonsymbology related parameters. These settings are typically sent when communications with the Barcode scanner are initiated
Scanned Data Report	CL	An Input report that the Bar Code Scanner uses to transmit decoded barcode data using the ASCII character set to the USB Host. *Note: All decoded data should be sent using ASCII characters. BCD and Hexadecimal representation are not recommended*
Raw Scanned Data Report	CL	An Input report that a Dumb Bar Code Scanner uses to transmit decoded barcode data to the USB Host
Trigger Report	CL	An Output report that a USB Host uses to trigger events on the Bar Code Scanner
Status Report	CL	An Input report that a Dumb Bar Code Scanner uses to communicate what it is presently doing. This information is especially needed when scan attempts are controlled by the USB Host
UPC/EAN Control Report	CL	An Output report that a USB Host uses to configure the UPC/EAN decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
EAN 2/3 Label Control Report	CL	An Output report that a USB Host uses to configure the EAN Two or Three label decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
Code 39 Control Report	CL	An Output report that a USB Host uses to configure the Code 39 decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
Interleaved 2 of 5 Control Report	CL	An Output report that a USB Host uses to configure the Interleaved 2 of 5 decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
Standard 2 of 5 Control Report	CL	An Output report that a USB Host uses to configure the Standard 2 of 5 decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
MSI Plessey Control Report	CL	An Output report that a USB Host uses to configure the MSI Plessey decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
Codabar Control Report	CL	An Output report that a USB Host uses to configure the Codabar decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
Code 128 Control Report	CL	An Output report that a USB Host uses to configure the Code 128 decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
Misc 1D Control Report	CL	An Output report that a USB Host uses to configure decoder software for miscellaneous 1D symbololgies (other than the ones with their own reports) within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated
2D Control Report	CL	An Output report that a USB Host uses to configure the 2D Symbology decoder software within the scanner. These settings are typically sent when communications with the Barcode scanner are initiated

32.3 Scanner Attributes

Usage Name	Usage Type	Description
Aiming/Pointer Mode	SF	Indicates the scanner supports an Aiming/Pointer Mode
Bar Code Present Sensor	SF	Indicates the scanner has a Bar Code Present sensor
Class 1A Laser	SF	Indicates the scanner meets the requirements of a Class 1A Laser product
Class 2 Laser	SF	Indicates that the scanner meets the requirements of a Class 2 Laser product
Heater Present	SF	Indicates that the scanner has a built-in or attached heater that allows the scanner to be used in very cold environments
Contact Scanner	SF	Indicates that the scanner is capable of reading barcodes at contact
Electronic Article Surveillance Notification	SF	Indicates that the scanner is capable of providing a signal after a good decode for invalidating EAS tags
Constant Electronic Article Surveillance	SF	Indicates that the scanner has an EAS antenna included
Error Indication	SF	Indicates that the scanner has an Error Indication
Fixed Beeper	SF	Indicates that the scanner does not have a programmable beeper
Good Decode Indication	SF	Indicates that the scanner has Good Decode Indication
Hands Free Scanning	SF	Indicates that the scanner has the capability of continuous-on hands free scanning
Intrinsically Safe	SF	Indicates that the scanner is safe for use in hazardous environments
Klasse Eins Laser	SF	Indicates that the scanner meets the requirements of a Klasse Eins Laser product
Long Range Scanner	SF	Indicates that the scanner can read barcodes beyond the arm's reach of an operator
Mirror Speed Control	SF	Indicates that the scanner can control the speed of its mirror
Not On File Indication	SF	Indicates that the scanner has a visual Not on File indication
Programmable Beeper	SF	Indicates that the scanner has a programmable beeper
Triggerless	SF	Indicates that the scanner does not have a trigger
Wand	SF	Indicates that the scanner reads barcodes with a wand element
Water Resistant	SF	Indicates that the scanner is water resistant
Multi-Range Scanner	SF	Indicates that the scanner can be used for both short and long range applications
Proximity Sensor	SF	Indicates that the scanner contains a sensor that detects an object in the scanner's field of view

32.4 Decoder

Usage Name	Usage Type	Description
Fragment Decoding	DF	Absolute, Indicates if the decoder will attempt to combine fragments of barcodes together to get a valid decode
Scanner Read Confidence	DV	Relative, Selects on a relative scale how much confidence the barcode reader should have in the read data before accepting it as a good decode. (1-10, 1=Least)

32.5 Data Prefix

Usage Name	Usage Type	Description
Data Prefix	NAry	Contains Prefix selector usages
Prefix AIMI	Sel	Decode data will be preceded with a three-character AIM identifier as defined in the standard documents ITS 98-002 or EN796
Prefix None	Sel	Decode data will be sent as decoded
Prefix Proprietary	Sel	Decode data will have a proprietary prefix

32.6 Laser/Motor Controls

Usage Name	Usage Type	Description
Active Time	DV	Duration that the triggerless scanner will operate in continuous on mode without any decode attempt before shutting down. (0.1 sec resolution)
Aiming Laser Pattern	DF	Triggers the display of an Aiming pattern on the barcode scanner
Bar Code Present	OOC	Indicates if a barcode sensor sees a barcode in view
Beeper State	OOC	Indicates if the beeper is presently sounding a beep
Laser On Time	DV	The amount of time the laser stays on in a triggered decode attempt if nothing is decoded (0.1 sec resolution)
Laser State	OOC	Indicates if the scanner is presently scanning a barcode
Lockout Time	DV	The amount of time that should elapse before scanning the same barcode again with a continuous on scanner. (0.01 sec resolution)
Motor State	OOC	Indicates if the motor is presently running on the scanner
Motor Timeout	DV	The amount of time that the motor on a scanner will continue to operate while there is no decoding of barcode data (0.1 sec resolution)
Power On Reset Scanner	DF	Triggers a Power On Reset on the barcode scanning device
Prevent Read of Barcodes	DF	While it has a value of 1, the barcode scanner will not read barcodes
Initiate Barcode Read	DF	While it has a value of 1, the barcode scanner should behave as if the mechanical trigger on the scanner was pulled
Trigger State	OOC	Indicates if the mechanical trigger on the scanner is pulled

32.6.1 Trigger Mode

Usage Name	Usage Type	Description
Trigger Mode	NAry	Contains Trigger Mode selector usages
Trigger Mode Blinking Laser On	Sel	Laser should blink while barcode data is not present and stay on continuously while barcode data is present
Trigger Mode Continuous Laser On	Sel	Laser should stay on all the time
Trigger Mode Laser on while Pulled	Sel	Laser should be on only while the trigger is pulled and the barcode reader has not yet read a barcode, or the laser on time is reached
Trigger Mode Laser stays on after release	Sel	Laser should go on when the trigger is pulled and should stay on until a barcode is read or the laser on time is reached

32.7 Configuration

Used to perform special operations with the Scanner's Non-Volatile memory based parameters

Usage Name	Usage Type	Description
Commit Parameters to NVM	DF	Triggers the writing of the barcode scanner's internal parameters into NVM memory
Parameter Scanning	DF	Indicates if the barcode reader's parameters can be changed by barcode menus
Parameters Changed	OOC	Indicates if any of the scanner's parameters were changed by the user
Set parameter default values	DF	Triggers the setting of the barcode scanner's internal parameters to their default settings

32.8 Connectivity

Used to monitor the presence of the scanner in cases when the scanner is not connected to the USB Host by a wire, but by through a base device.

Usage Name	Usage Type	Description
Scanner In Cradle	OOC	Indicates if the scanner is presently on the cradle
Scanner In Range	OOC	Indicates if a cordless scanner is presently within range for communicating

32.9 User Interface

Usage Name	Usage Type	Description
Aim Duration	DV	Duration that the scanner will remain in AIM mode before turning off (0.1 sec resolution)
Good Read Lamp Duration	DV	Amount of time the Good Read lamp should stay illuminated after a good read (0.01 sec resolution)
Good Read Lamp Intensity	DV	Sets the brightness of the Good Read lamp (0 = disable)
Good Read LED	DF	Turns the Good Read LED on or off
Good Read Tone Frequency	DV	Frequency of the Good Read Tone
Good Read Tone Length	DV	Length of Good Read Tone (0.01 sec resolution)
Good Read Tone Volume	DV	Volume of Good Read Tone
No Read Message	DF	Indicates if a message should be sent to indicate an unsuccessful attempt to scan a barcode
Not on File Volume	DV	The volume of the Not on File beep
Powerup Beep	DF	Indicates if the barcode reader should beep when powering up (or after a POR)
Sound Error Beep	DF	Triggers the sounding of an Error Beep
Sound Good Read Beep	DF	Triggers the sounding of a Good Read Beep
Sound Not On File Beep	DF	Triggers the sounding of a Not on File Beep

32.9.1 Good Read When to Indicate

Usage Name	Usage Type	Description
Good Read When to Write	NAry	Contains GRWTI selector usages
GRWTI After Decode	Sel	Beep/Lamp only after decode
GRWTI Beep/Lamp after transmit	Sel	Beep/Lamp after transmit completes
GRWTI No Beep/Lamp use at all	Sel	No Beep/Lamp after decode or transmit

32.10 UPC/EAN

Usage Name	Usage Type	Description
Bookland EAN	DF	Indicates if EAN barcodes with Bookland data format should be decoded
Convert EAN 8 to 13 Type	DF	Indicates if EAN-8 decoded barcodes should be converted to be a comparable EAN-13 barcode
Convert UPC A to EAN-13	DF	Indicates if UPC-A decoded barcodes should be converted to be a comparable EAN-13 barcode
Convert UPC-E to A	DF	Indicates if UPC-E decoded barcodes should be converted to be a comparable UPC-A barcode
EAN-13	DF	Indicates if EAN-13 barcodes should be decoded
EAN-8	DF	Indicates if EAN-8 barcodes should be decoded
EAN-99 128 Mandatory	DF	Indicates if EAN-99 barcodes with 128 Mandatory format should be decoded
EAN-99 P5/128 Optional	DF	Indicates if EAN-99 barcodes with five-digit periodical or 128 optional format should be decoded
Enable EAN Two Label	DF	Indicates if EAN Two Label barcodes should be decoded
UPC/EAN	DF	Indicates if UPC/EAN barcodes should be decoded
UPC/EAN Coupon Code	DF	Indicates if UPC/EAN Coupon Code barcodes should be decoded
UPC/EAN Periodicals	DV	Indicates if UPC/EAN periodicals should be decoded
UPC-A	DF	Indicates if UPC-A barcodes should be decoded
UPC-A with 128 Mandatory	DF	Indicates if UPC-A barcodes with 128 Mandatory format should be decoded
UPC-A with 128 Optional	DF	Indicates if UPC-A barcodes with 128 Optional format should be decoded
UPC-A with P5 Optional	DF	Indicates if UPC-A barcodes with five-digit Periodical data format should be decoded
UPC-E	DF	Indicates if UPC-E barcodes should be decoded
UPC-E1	DF	Indicates if UPC-E1 barcodes should be decoded

32.10.1 UPC/EAN Periodical

Usage Name	Usage Type	Description
Periodical	NAry	Contains Periodical selector usages
Periodical Auto-Discriminate +2	Sel	Read UPC/EAN barcodes with or without periodical data
Periodical Only Decode with +2	Sel	Only read UPC/EAN barcodes with periodicals
Periodical Ignore +2	Sel	Ignore UPC/EAN periodical data within barcode
Periodical Auto-Discriminate +5	Sel	Read UPC/EAN barcodes with or without periodical data
Periodical Only Decode with +5	Sel	Only read UPC/EAN barcodes with periodicals
Periodical Ignore +5	Sel	Ignore UPC/EAN periodical data within barcode

32.10.2 Price/Weight Check

Usage Name	Usage Type	Description
Check	NAry	Contains Check selector usages
Check Disable Price	Sel	Do not perform a price/weight check
Check Enable 4 digit Price	Sel	Enable four-digit price/weight check
Check Enable 5 digit Price	Sel	Enable five-digit price/weight check
Check Enable European 4 digit Price	Sel	Enable European four-digit price/weight check
Check Enable European 5 digit Price	Sel	Enable European five-digit price/weight check

32.11 EAN Two or Three Labels

Indicates how EAN Two Label and Three Label barcodes should be read (if at all). The bar code scanner may store one or more records of data that indicates the combination of flag digits that must be contained within the barcodes to successfully decode as an EAN Two or Three label barcode.

Usage Name	**Usage Type**	**Description**
EAN Two Label	DF	Indicates if two EAN barcodes should be decoded as one providing that the flag digits match the pre-specified values
EAN Three Label	DF	Indicates if three EAN barcodes should be decoded as one providing that the flag digits match the pre-specified values
EAN 8 Flag Digit 1	DV	The value of a Flag Digit that should be present in an EAN 8 barcode to be decoded as an EAN Two or Three label barcode (as specified in an EAN 2/3 Label Control Report
EAN 8 Flag Digit 2	DV	The value of a Flag Digit that should be present in an EAN 8 barcode to be decoded as an EAN Two or Three label barcode (as specified in an EAN 2/3 Label Control Report
EAN 8 Flag Digit 3	DV	The value of a Flag Digit that should be present in an EAN 8 barcode to be decoded as an EAN Two or Three label barcode (as specified in an EAN 2/3 Label Control Report
EAN 13 Flag Digit 1	DV	The value of a Flag Digit that should be present in an EAN 13 barcode to be decoded as an EAN Two or Three label barcode (as specified in an EAN 2/3 Label Control Report
EAN 13 Flag Digit 2	DV	The value of a Flag Digit that should be present in an EAN 13 barcode to be decoded as an EAN Two or Three label barcode (as specified in an EAN 2/3 Label Control Report
EAN 13 Flag Digit 3	DV	The value of a Flag Digit that should be present in an EAN 13 barcode to be decoded as an EAN Two or Three label barcode (as specified in an EAN 2/3 Label Control Report
Add EAN 2/3 Label Definition	DF	Indicates that the EAN 2/3 Label Control Report contains a definition of a new group of Flag Digits for the decoding of an EAN Two Label or Three Label barcode
Clear all EAN 2/3 Label Definitions	DF	Indicates that the all EAN 2/3 Label definitions stored in the bar code reader should be erased

32.12 Other 1D Symbology

Usage Name	Usage Type	Description
BC412	DF	Indicates if BC 412 barcodes should be decoded
Codabar	DF	Indicates if Codabar barcodes should be decoded
Code 128	DF	Indicates if Code 128 barcodes should be decoded
Code 39	DF	Indicates if Code 39 barcodes should be decoded
Code 93	DF	Indicates if Code 93 barcodes should be decoded
Full ASCII Conversion	DF	Indicates if Code 39 Full ASCII conversion should be done
Interleaved 2 of 5	DF	Indicates if Interleaved 2 of 5 barcodes should be decoded
Italian Pharmacy Code	DF	Indicates if Italian Pharmacy formatted Code 39 barcodes should be decoded
MSI/Plessey	DF	Indicates if MSI/Plessey barcodes should be decoded
Standard 2 of 5 IATA	DF	Indicates if Standard 2 of 5 barcodes with IATA spacing should be decoded
Standard 2 of 5	DF	Indicates if Standard 2 of 5 barcodes should be decoded
Transmit Start/Stop	DF	Indicates if Codabar start/stop characters should be transmitted
Tri-Optic	DF	Indicates if Tri-Optic Code 39 barcodes should be decoded
UCC/EAN-128	DF	Indicates if UCC/EAN-128 barcodes should be decoded and output using standard label identifiers. This option overrides the none or proprietary selection for the Data Prefix selection for Code 128 labels which are not UCC/EAN-128 bar codes. *Note: The scanner will decode the UCC/EAN-128 tag, but if UCC/EAN-128 is not selected any Function 1 characters in the data stream will not be output as Group Seperator characters per USS-128*

32.12.1 Check Digit

Usage Name	Usage Type	Description
Check Digit	NAry	Contains Check Digit selector usages
Check Digit Disable	Sel	Do not verify check digit for code type
Check Digit Enable Interleaved 2 of 5 OPCC	Sel	Verify OPCC format check digits for Interleaved 2 of 5 barcodes
Check Digit Enable Interleaved 2 of 5 USS	Sel	Verify USS format check digits for Interleaved 2 of 5 barcodes
Check Digit Enable Standard 2 of 5 OPCC	Sel	Verify OPCC format check digits for Standard 2 of 5 barcodes
Check Digit Enable Standard 2 of 5 USS	Sel	Verify USS format check digits for Standard 2 of 5 barcodes
Check Digit Enable One MSI Plessey	Sel	Check for one MSI/Plessey check digit
Check Digit Enable Two MSI Plessey	Sel	Check for two MSI/Plessey check digits
Check Digit Codabar Enable	Sel	Verify check digits for Codabar barcodes
Check Digit Code 39 Enable	Sel	Verify check digits for Code 39 barcodes

32.12.2 Transmit Check Digit

Usage Name	Usage Type	Description
Transmit Check Digit	NAry	Contains Check Digit selector usages
Disable Check Digit Transmit	Sel	Do not transmit check digit for the code type
Enable Check Digit Transmit	Sel	Transmit the check digits for the code type

32.13 Decode Data

Usage Name	Usage Type	Description
Symbology Identifier 1	DV	Contains the first character of the Symbology Identifier for the Barcode that was just decoded. If the scanner does not provide this data, then it can omit this usage from its report.
Symbology Identifier 2	DV	Contains the second Symbology Identifier (see Symbology Identifier 1)
Symbology Identifier 3	DV	Contains the third Symbology Identifier (see Symbology Identifier 1)
Decoded Data	DV	Contains the ASCII data that was just decoded. Very long barcodes can be sent to the USB host in chunks (see "Decode Data Continued")
Decode Data Continued	DF	When set, this bit indicates that the Decode data is continued with the next report. This usage is needed for scanners that process 2D symbology barcodes and "Dumb Scanners". These barcodes can contain anywhere from 1 to 1024 bytes of data or more. The use of this continue bit enables the barcode scanner to declare an output buffer in the size that it can handle given available resources
Bar Space Data	DV	Contains barcode data that was read by a "Dumb Scanner". The barcode is represented as a stream of values with each value indicating the relative length of a bar or a space (with the maximum allowed value indicating an overflow). In most cases the units can be microseconds. But in the case of slower devices such as wands, the data may need to be scaled down to fit within the allocated size of the value. This type of scan data can be useful for systems that evaluate the quality of barcodes or barcode scanner systems. This type of data can also be useful in cases where the scanner is reading a new code type that is not yet supported in the scanner (providing that the appropriate decode software resides on the USB Host
Scanner Data Accuracy	DV	Contains the smallest unit of time that is reported by the barcode scanner

32.14 Raw Data Polarity

Usage Name	Usage Type	Description
Raw Data Polarity	NAry	Contains Polarity selector usages
Polarity Inverted Bar Code	Sel	A barcode was read with a Non-White margin. The first timing value in the Bar Space Data (the margin) is of a dark element
Polarity Normal Bar Code	Sel	A barcode was read with a White margin. The first timing value in the Bar Space Data (the margin) is of a White element

32.15 Decode Data Length

Used for linear code types (e.g. Code 39, Standard 2 of 5, Interleaved 2 of 5) to specify the size of the barcodes that are to be decoded. These length usages will be specified by the USB Host and honored (where supported) by the Scanning device. These usages can not be used to specify an overall min/max length for the scanner.

Usage Name	Usage Type	Description
Minimum Length to Decode	DV	Contains the smallest length that may be decoded for a given code type. 0 = No Minimum
Maximum Length to Decode	DV	Contains the largest length that may be decoded for a given code type. 0 = No Maximum
Discrete Length to Decode 1	DV	Contains a length that may be decoded for a given code type. 0 = Not Specified
Discrete Length to Decode 2	DV	Contains a length that may be decoded for a given code type. 0 = Not Specified

32.15.1 Data Length Method

Specifies how lengths should be checked by the Scanner for a specific code type. These usages are only needed when the Scanner allows the user to select either a range of lengths or one or more discrete lengths. If these usages are not defined, then discrete length definitions will take precedence over defined length ranges.

Usage Name	Usage Type	Description
Data Length Method	NAry	Contains DL Method selector usages
DL Method Read any	Sel	Bar Codes of any length should be read for the code type
DL Method Check in Range	Sel	Bar Codes should only be read within the specified range
DL Method Check for Discrete	Sel	Bar Codes should only be read for the one or more specified lengths

32.16 2D Symbology

Usage Name	**Usage Type**	**Description**
Aztec Code	DF	Indicates if Aztec barcodes should be decoded
Channel Code	DF	Indicates if Channel Code barcodes should be decoded
Code 16	DF	Indicates if Code 16 barcodes should be decoded
Code 32	DF	Indicates if Code 32 barcodes should be decoded
Code 49	DF	Indicates if Code 49 barcodes should be decoded
Code One	DF	Indicates if Code One barcodes should be decoded
Colorcode	DF	Indicates if Colorcode barcodes should be decoded
Data Matrix	DF	Indicates if Data Matrix barcodes should be decoded
MaxiCode	DF	Indicates if Maxi Code barcodes should be decoded
MicroPDF	DF	Indicates if Micro PDF barcodes should be decoded
PDF-417	DF	Indicates if PDF-417 barcodes should be decoded
PosiCode	DF	Indicates if PosiCode barcodes should be decoded
QR Code	DF	Indicates if QR Code barcodes should be decoded
SuperCode	DF	Indicates if Super Code barcodes should be decoded
UltraCode	DF	Indicates if Ultra Code barcodes should be decoded
USD-5 (Slug Code)	DF	Indicates if USD-5 (Slug Code) barcodes should be decoded
VeriCode	DF	Indicates if VeriCode barcodes should be decoded

33 Scales Page (0x8D)

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**Scales**	CA	33.1
02-1F	*Reserved*		
20	**Scale Device**	CL	33.2
21	**Scale Class**	NAry	33.2
22	Scale Class I Metric	Sel	33.2
23	Scale Class II Metric	Sel	33.2
24	Scale Class III Metric	Sel	33.2
25	Scale Class IIIL Metric	Sel	33.2
26	Scale Class IV Metric	Sel	33.2
27	Scale Class III English	Sel	33.2
28	Scale Class IIIL English	Sel	33.2
29	Scale Class IV English	Sel	33.2
2A	Scale Class Generic	Sel	33.2
2B-2F	*Reserved*		
30	**Scale Attribute Report**	CL	33.3
31	**Scale Control Report**	CL	33.3
32	**Scale Data Report**	CL	33.3
33	**Scale Status Report**	CL	33.3
34	**Scale Weight Limit Report**	CL	33.3
35	**Scale Statistics Report**	CL	33.3
36-3F	*Reserved*		
40	Data Weight	DV	33.4
41	Data Scaling	DV	33.4
42-4F	*Reserved*		
50	**Weight Unit**	CL	33.4.1
51	Weight Unit Milligram	Sel	33.4.1
52	Weight Unit Gram	Sel	33.4.1
53	Weight Unit Kilogram	Sel	33.4.1
54	Weight Unit Carats	Sel	33.4.1
55	Weight Unit Taels	Sel	33.4.1
56	Weight Unit Grains	Sel	33.4.1
57	Weight Unit Pennyweights	Sel	33.4.1
58	Weight Unit Metric Ton	Sel	33.4.1
59	Weight Unit Avoir Ton	Sel	33.4.1
5A	Weight Unit Troy Ounce	Sel	33.4.1
5B	Weight Unit Ounce	Sel	33.4.1
5C	Weight Unit Pound	Sel	33.4.1
5D-5F	*Reserved*		
60	Calibration Count	DV	33.5

61	Re-Zero Count	DV	33.5
62-6F	*Reserved*		
70	**Scale Status**	NAry	33.6
71	Scale Status Fault	Sel	33.6
72	Scale Status Stable at Center of Zero	Sel	33.6
73	Scale Status In Motion	Sel	33.6
74	Scale Status Weight Stable	Sel	33.6
75	Scale Status Under Zero	Sel	33.6
76	Scale Status Over Weight Limit	Sel	33.6
77	Scale Status Requires Calibration	Sel	33.6
78	Scale Status Requires Rezeroing	Sel	33.6
79-7F	*Reserved*		
80	Zero Scale	OOC	33.7
81	Enforced Zero Return	OOC	33.7
82-FFFF	*Reserved*		

Table 33.1: Scales Page

33.1 Scale Devices

Usage Name	Usage Type	Description
Scales	CA	General weighing device

33.2 Class

Scale classifications are those recognized by the National Institute of Standards and Technology (NIST). A generic classification has been provided for scales that fall outside the NIST classification.

Usage Name	Usage Type	Description
Scale Device	CL	Contains one or more weighting device or Scale related usages
Scale Class	NAry	Contains Scale Class selectors
Scale Class I Metric	Sel	Precision laboratory weighing device. Measurement units are typically in milligrams
Scale Class II Metric	Sel	Laboratory weighing device; precious metals and gem weighing, grain test scales. Measurement units are typically in milligrams
Scale Class III Metric	Sel	All retail weighing not otherwise specified; grain test scales, retail precious metals and semi-precious gem weighing, animal scales, postal scales, scales used to determine laundry charges and vehicle on-board weighing systems. Measurement units are typically in grams
Scale Class IIIL Metric	Sel	Vehicle, axle-load, livestock, railway track scales, crane, hopper scales, and vehicle on-board weighing systems. Measurement units are in typically kilograms
Scale Class IV Metric	Sel	Wheel load weighers and portable axle load weighers used for highway weight enforcement. Measurement units are typically in grams
Scale Class III English	Sel	All retail weighing not otherwise specified; grain test scales, retail precious metals and semi-precious gem weighing, animal scales, postal scales, scales used to determine laundry charges and vehicle on-board weighing systems. Measurement units are typically in fractions of pounds
Scale Class IIIL English	Sel	Vehicle, axle-load, livestock, railway track scales, crane, hopper scales, and vehicle on-board weighing systems. Measurement units are typically in pounds
Scale Class IV English	Sel	Wheel load weighers and portable axle load weighers used for highway weight enforcement. Measurement units are typically in fractions of pounds
Scale Class Generic	Sel	Scales not falling under previous classifications

33.3 Reports

Standardized groupings of reports.

Usage Name	Usage Type	Description
Scale Attribute Report	CL	Specifies static attributes
Scale Control Report	CL	Controls scale operation, namely to get or set the state of the Enforced Zero Return control
Scale Data Report	CL	Transmits current status and weight data. Typically contains the Scale Unit, Data Scaling and Data Weight usages
Scale Status Report	CL	Describes changes to the device status
Scale Weight Limit Report	CL	Used to identify the maximum weight limit of the scale. This collection typically contains the Scale Unit, Data Scaling and Data Weight usages
Scale Statistics Report	CL	Used to query the current operational statistics of the scale. These statistics include the number of times the scale has been re-zeroed or calibrated.

33.4 Data

Usage Name	Usage Type	Description
Data Weight	DV	A binary value representing the weight present on the scale
Data Scaling	DV	A numeric value representing the scaling applied to the data as a base ten exponent. Range is from 127 to -127

33.4.1 Weight Units

Usage Name	Usage Type	Description
Weight Unit	CL	Contains Scale Unit selectors
Weight Unit Milligram	Sel	Data units are in milligrams
Weight Unit Gram	Sel	Data units are in grams
Weight Unit Kilogram	Sel	Data units are in kilograms
Weight Unit Carats	Sel	Data units are in Carats
Weight Unit Taels	Sel	Data units are in Taels
Weight Unit Grains	Sel	Data units are in Grains
Weight Unit Pennyweights	Sel	Data units are in Pennyweights
Weight Unit Metric Ton	Sel	Data units are in metric ton
Weight Unit Avoir Ton	Sel	Data units are in avoir ton
Weight Unit Troy Ounce	Sel	Data units are in troy ounces
Weight Unit Ounce	Sel	Data units are in ounces
Weight Unit Pound	Sel	Data units are in pounds

33.5 Statistics Data

Usage Name	Usage Type	Description
Calibration Count	DV	Number of times that the scale has been calibrated since manufacture
Re-Zero Count	DV	Number of times the scale has been zeroed since power on

33.6 Scale Status

Usage Name	Usage Type	Description
Scale Status	NAry	Contains Scale Status selectors
Scale Status Fault	Sel	Some internal scale fault has occurred
Scale Status Stable at Center of Zero	Sel	The weight is stable and at zero
Scale Status In Motion	Sel	The scale is not stable; i.e. moving
Scale Status Weight Stable	Sel	Weight on scale is stable and valid
Scale Status Under Zero	Sel	Weight is stable but is measured at less than zero
Scale Status Over Weight Limit	Sel	Weight is stable but exceed the capacity of the scale
Scale Status Requires Calibration	Sel	Scale must be calibrated before data is available
Scale Status Requires Rezeroing	Sel	Scale must be zeroed before data is available

33.7 Device Control

Usage Name	Usage Type	Description
Zero Scale	OOC	When enabled, the scale will attempt to set the current weight on the scale as the zero weigh point
Enforced Zero Return	OOC	When enabled, the scale will require that the weight on the scale must return to zero between weight requests

34 Magnetic Stripe Reader Page (0x8E)

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**MSR Device Read-Only**	CA	34.1
02-10	*Reserved*		
11	Track 1 Length	DV	34.2
12	Track 2 Length	DV	34.2
13	Track 3 Length	DV	34.2
14	Track JIS Length	DV	34.2
15-1F	*Reserved*		
20	Track Data	SF/DF/DV	34.2
21	Track 1 Data	SF/DF/DV	34.2
22	Track 2 Data	SF/DF/DV	34.2
23	Track 3 Data	SF/DF/DV	34.2
24	Track JIS Data	SF/DF/DV	34.2
25-FFFF	*Reserved*		

Table 34.1: Magnetic Stripe Reader Page

34.1 Magnetic Stripe Reader Devices

Usage Name	Usage Type	Description
MSR Device Read-Only	CA	Reader of MSR cards

34.2 Track Information

Usage Name	Usage Type	Description
Track 1 Length	DV	Indicates the length of Track 1 data
Track 2 Length	DV	Indicates the length of Track 2 data
Track 3 Length	DV	Indicates the length of Track 3 data
Track JIS Length	DV	Indicates the length of Track JIS data
Track Data	SF/DF/DV	Used to indicate data from all tracks, when track data is not separated by reader, but is packed. Individual tracks are then normally located using the 'Track n Length' fields, and appear in the same order as the track length fields. This allows a device to implement several different reports and choose the shortest one that accommodates all data read from the magnetic stripe, rather than always sending a report large enough to accommodate the largest possible report
Track 1 Data	SF/DF/DV	Indicates this device can read Track 1 (from the card), or the source of the data[1]
Track 2 Data	SF/DF/DV	Indicates this device can read Track 2 (from the card), or the source of the data[1]
Track 3 Data	SF/DF/DV	Indicates this device can read Track 3 (from the card), or the source of the data[1]
Track JIS Data	SF/DF/DV	Indicates this device can read Track JIS (from the card), or the source of the data[1]

[1] The data is a number of octets that contain the full bit stream extracted from the magnetic stripe. The first bit read from the track will be delivered as the LSB of the first octet of "Track # Data". The eighth bit read from the track will be the MSB of the first octet. The ninth bit from the track will be the LSB of the second octet. And so forth

35 Camera Control Page (0x90)

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01-1F	*Reserved*		
20	Camera Auto-focus [21]	OSC	35.1
21	Camera Shutter [21]	OSC	35.1
22-FFFF	*Reserved*		

Table 35.1: Camera Control Page

35.1 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.

36 Arcade Page (0x91)

Defines usages for arcade gaming machines, with GPIO, coin slots, pin pads, etc.

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**General Purpose IO Card**	CA	36.1
02	**Coin Door**	CA	36.2
03	**Watchdog Timer**	CA	36.3
04-2F	*Reserved*		
30	General Purpose Analog Input State	DV	36.1
31	General Purpose Digital Input State	DV	36.1
32	General Purpose Optical Input State	DV	36.1
33	General Purpose Digital Output State	DV	36.1
34	Number of Coin Doors	DV	36.2
35	Coin Drawer Drop Count	DV	36.2
36	Coin Drawer Start	OOC	36.2
37	Coin Drawer Service	OOC	36.2
38	Coin Drawer Tilt	OOC	36.2
39	Coin Door Test	OOC	36.2
3A-3F	*Reserved*		
40	Coin Door Lockout	OOC	36.2
41	Watchdog Timeout	DV	36.3
42	Watchdog Action	NAry	36.3
43	Watchdog Reboot	Sel	36.3
44	Watchdog Restart	Sel	36.3
45	Alarm Input	DV	36.3
46	Coin Door Counter	OOC	36.2
47	I/O Direction Mapping	DV	36.1
48	Set I/O Direction Mapping	DV	36.1
49	Extended Optical Input State	DV	36.1
4A	Pin Pad Input State	DV	36.1
4B	Pin Pad Status	DV	36.1
4C	Pin Pad Output	OOC	36.1
4D	Pin Pad Command	DV	36.1
4E-FFFF	*Reserved*		

Table 36.1: Arcade Page

36.1 General Purpose IO

Game controller interface cards are typically implemented as a general purpose input/output card that provides multiple digital, analog and optical inputs as well as digital outputs.

Usage Name	Usage Type	Description
General Purpose IO Card	CA	General-purpose interface card that is used to attach a variety of devices. Typically consists of generalized analog, digital and optical, input and output ports.
General Purpose Analog Input State	DV	State of a general-purpose analog input.
General Purpose Digital Input State	DV	State of a general-purpose digital input.
General Purpose Optical Input State	DV	State of a general-purpose optical input. Typically from an optical mouse or other optically encoded device.
General Purpose Digital Output State	DV	State of a general-purpose digital output.
I/O Direction Mapping	DV	Direction of an I/O line. 1 = Input, 0 = Output
Set I/O Direction Mapping	DV	Direction of an I/O line. 1 = Input, 0 = Output
Extended Optical Input State	DV	Used for trackball devices and high-rate digital counters.
Pin Pad Input State	DV	
Pin Pad Status	DV	
Pin Pad Output	OOC	
Pin Pad Command	DV	

36.2 Coin Door

Usage Name	Usage Type	Description
Coin Door	CA	Coin door device used in arcade and other standalone billing applications.
Number of Coin Doors	DV	Number of coin drawers supported by a device.
Coin Drawer Drop Count	DV	Number of coins dropped by the user.
Coin Drawer Start	OOC	The Start button associated with a particular coin door.
Coin Drawer Service	OOC	
Coin Drawer Tilt	OOC	Tamper indicator.
Coin Door Test	OOC	
Coin Door Lockout	OOC	An output to the device that disables the coin door.
Coin Door Counter	OOC	

36.3 Watchdog Timer

Watchdog timers are used to recover from catastrophic hardware or software failures. If the timeout value is not updated in a timely manner it is assumed that control of the device has been lost by the software and an error recovery operation is enforced. Depending on the failure type, a hardware or a software recovery may be required. The actions recovery supported by a device are declared in the Watchdog Action collection. If a device only supports hardware reset then only the Watchdog Action Reboot usage will be declared.

Usage Name	**Usage Type**	**Description**
Watchdog Timer	CA	Generalized watchdog timer device.
Watchdog Timeout	DV	The duration, in seconds, before the Watchdog Action is invoked. Software must update this on a timely basis to prevent the Watchdog Action from automatically occuring.
Watchdog Action	NAry	Identifies the action to be performed by the watchdog timer. This collection will contain one of the following Watchdog Action usages.
Watchdog Reboot	Sel	Performs a hardware reset upon a Watchdog Timer timeout.
Watchdog Restart	Sel	Performs a software reset upon a Watchdog Timer timeout.
Alarm Input	DV	

37 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

38 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[1].

Usage ID	Usage Name	Usage Types	Section
00	*Undefined*		
01	**U2F Authenticator Device**	CA	38.1
02-1F	*Reserved*		
20	Input Report Data	DV	38.1
21	Output Report Data	DV	38.1
22-FFFF	*Reserved*		

Table 38.1: Fast IDentity Online Alliance Page

[1] https://fidoalliance.org/specs/fido-u2f-v1.0-ps-20141009/fido-u2f-hid-protocol-ps-20141009.html

38.1 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 *response* data compliant with U2FHID Protocol specification.
Output Data Report	DV	Device *request* 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	FDF5E6
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	FFEFD5
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	*Reserved*	
255	No Preferred Color	

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