

# Windows Platform Design Notes

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*Designing Hardware for the Microsoft® Windows® Family of Operating Systems*

## Keyboard Scan Code Specification

**Abstract:** This specification details the PS/2 Scan Codes and USB Usage Tables that are validated for compliance to the Microsoft® Windows® Logo Program testing standard. This document details the alternative make and break PS/2 scan code and USB code response for the Windows Logo Key and Application Keys, plus Advanced Configuration and Power Interface (ACPI) power controls.

This specification was previously published, with the same content, as “Windows Hardware Quality Labs Keyboard Specification” and also referred to as “Windows Keys Specification” and “New Keys Specification.”

**Revision 1.3a — March 16, 2000**

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## Notice of Change

This version of the Keyboard Scan Code Specification details the PS/2 Scan Codes and USB Usage Tables that are validated for compliance to the Microsoft Windows Logo Program testing standard. This document details the alternative make and break PS/2 scan code and USB code response for the Windows Logo key, Application Keys, and Advanced Configuration & Power Interface (ACPI) power controls.

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This document supercedes all versions of the New Keys Specifications for the Windows Keys and Windows Hardware Quality Labs WHQL Keyboard Specification. There is no change required for developers of Windows-based applications to support any compatible implementation.

**\*\*\*IMPORTANT\*\*\***

**As of August 1, 1996, your keyboard must pass the Windows keyboard testing at the Windows Hardware Quality Labs either prior to, or in conjunction with, the Windows Key Logo testing.**

The requirements for compatibility testing are not changed, and a keyboard vendor can implement these new keys successfully following the 1.0, 1.1, or 1.2 versions of the New Keys Specification. There is no change required for developers of Windows-based applications to support any compatible implementation.

**Revision History**

| Revision | Date    | Comments   |
|----------|---------|--|
| 1.3a     | 3/16/00 | Adjusted title and related references                        |
| 1.3      | 2/23/99 | Apps key removed as modifier, Hid audio control usages added |
| 1.2      | 6/25/98 | ACPI Codes corrected.  |
| 1.1      | 5/1/98  | Scan Code Set 3 requirement removed.                         |
| 1.0      | 3/27/98 | Initial proposal for consideration.                          |
|          |         |  |

## Windows Keys Support for Windows Software Applications

The three Windows Keys report the following key codes in the Microsoft Windows 95, Windows 98, and Windows NT® operating systems, and future versions of Windows operating systems.

### Key Codes for Scan Code Set 1:

| Windows Key   | Make  | Break | Windows Virtual Key |
|---------------|-------|-------|---------------------|
| Left Windows  | E0 5B | E0 DB | <b>5B</b>           |
| Right Windows | E0 5C | E0 DC | <b>5C</b>           |
| Application   | E0 5D | E0 DD | <b>5D</b>           |

### Key Codes for Scan Code Set 2:

| Windows Key   | Make  | Break    | Windows Virtual Key |
|---------------|-------|----------|---------------------|
| Left Windows  | E0 1F | E0 F0 1F | <b>5B</b>           |
| Right Windows | E0 27 | E0 F0 27 | <b>5C</b>           |
| Application   | E0 2F | E0 F0 2F | <b>5D</b>           |

### Key Codes for USB Usage Tables:

| Windows Key   | Usage Page | Usage Index (Dec) | Usage Index (Hex) | Typical AT-101 position |
|---------------|------------|-------------------|-------------------|-------------------------|
| Left Windows  | 0x07       | 227               | E3                | 127                     |
| Right Windows | 0x07       | 231               | E7                | 128                     |
| Application   | 0x07       | 101               | 65                | 129                     |

## What Software Applications Vendors Should Support and How

To provide support for the Windows Keys, an application should support the application key virtual key scan code (5D) as a context menu event similar to a right mouse button click in some applications today.

Applications vendors are encouraged to extend their support beyond the application key to include support for application key combinations like CTRL+Application, ALT+Application and SHIFT+Application. These key combinations are reserved for applications to support. Support for Windows+Application is reserved for the operating system.

| Application Key Combinations           | Recommended Support  |
|--|--|
| CTRL + Application Key                 | unspecified, application specific  |
| ALT + Application Key                  | unspecified, application specific  |
| SHIFT + Application Key                | unspecified, application specific  |
| Windows + Application Key              | <i>reserved for operating system</i>                                     |
| Application Key + <alpha numeric keys> | not supported as a modifier key, support must be supplied by application |

## Suggestions for Support of Application Key Combinations

- Context menu at the location of the text cursor (instead of the mouse pointer)
- Launch automated help agent
- Pop up list of last 5 actions (or list of commonly accessed functions)
- Enable/Disable macro recording or other user controllable features
- Switch to next open window in a multiple document
- User assignable key through an application UI

## Application Key Support in the Microsoft Windows Operating Systems



The application key will primarily function to bring up a context menu at the selection or mouse pointer. This functionality is the same as the right mouse button click in some applications today.

| Operating System | Application Key Response Supported by the Operating System |
|------------------|--|
|                  | Windows 3.x  |
| Windows NT 3.5x  | no response <sup>1</sup>                                   |
| Windows NT 4.0   | context menu on selection                                  |
| Windows NT 4.0   | context menu on selection                                  |
| Windows 95       | context menu on selection                                  |
| Windows 98       | context menu on selection                                  |

<sup>1</sup> Windows still reports a 5D virtual key code which means that applications can enable functionality

## Using the Windows Logo Key Logo and Application Key Logo in Documentation

The Windows Logo key and the Application Logo key may be used by OEMs, ISVs and IHVs in documentation that describes the functionality of the Logo keys, provided such description is consistent with Microsoft's guidelines for use of the Logo keys.

- It is not necessary to obtain a Logo license from Microsoft in order to refer to the Logo keys in documentation. This is the only permissible non-licensed use of the Windows Logo.
- The Logos may not be used in any way other than as specified in the Logo license guidelines.
- Upon request, Microsoft will provide camera-ready artwork of the Logos to be used in documentation. Send your e-mail request to Microsoft Windows Hardware Quality Labs at [whqlinfo@microsoft.com](mailto:whqlinfo@microsoft.com) with "Artwork Request" in your subject line. Alternatively, you may use the Windows flag symbol provided in the "Wingdings®" font. This character is available by pressing ALT + 0255 on the numeric keypad.
- You may not alter the Logos in any way.
- The Logos should be typed with an empty space before and after each symbol, followed by a plus sign and another space, followed by the modifier if appropriate. Examples are shown:  
Windows Logo key + B or  + B  
Application key + S or  + S

## Windows Logo Key Support (Reserved for Operating System Use)

The Windows Logo keys are reserved for system level functions. Software developers should not implement support for the Windows Logo keys in Windows 95, Windows 98, or Windows NT-based applications. The Windows Logo keys are supported in the operating system and provide system level functionality to the end user. The following table lists a few of the Windows Logo key combinations and their functionality. This list is not exhaustive and additional combinations will be used by the Microsoft Windows 95, Windows 98, or Windows NT operating systems.

| Windows Logo Key Combination | Functionality in Windows 95/98                  |
|------------------------------|---|
| Windows + F1                 | Display the popup menu for the selected object. |
| Windows + TAB                | Activate next Taskbar button.                   |
| Windows + E                  | Explore My Computer.                            |
| Windows + F                  | Find Document.                                  |
| Windows + CTRL + F           | Find Computer.                                  |
| Windows + M                  | Minimize All.                                   |
| SHIFT + Windows + M          | Undo Minimize All.                              |
| Windows + R                  | Display Run dialog box.                         |
| Windows + PAUSE (Break)      | Perform a system function.                      |

## Windows Keys Support for OEMs and Keyboard IHVs

OEMs that buy their keyboards with Windows Logo keys from a licensed keyboard manufacturer and do not modify the keyboard product except to add their Logo and other cosmetic changes are not required to license the Windows Logo keys from Microsoft. If the OEM product changes the layout or BIOS of an already licensed keyboard the OEM must go through the same licensing and certification procedure as described in the next section of this document.

### Software Support of the Windows Keys in the Windows 95/98 Operating System

The Windows Keys are supported in the Windows 95, Windows 98, or Windows NT operating systems user interface. Application vendors will enable functionality for the Application key in their applications. 10 Windows Logo key combinations are reserved for OEM use.

| Key Event Supported           | Windows Support           | Application Support       | OEM System Utilities       |
|-------------------------------|---------------------------|---------------------------|----------------------------|
| Windows Logo Key              | open the Start menu       |                           |                            |
| Windows Logo key Combinations | 9 shortcut functions      |                           | Win + 1-0 reserved for OEM |
| Application Logo Key          | context menu on selection | context menu on selection | context menu on selection  |
| CTRL, ALT, SHIFT+Application  |                           | varies by application     | varies by utility          |

### Special Keys Reserved for OEM Usage

Ten (10) Windows Logo keys combinations have been reserved for OEM use. These keys can be used by OEMs to provide keyboard hotkey controls for Speaker Volume, Monitor/LCD Brightness or Contrast, Password, or other value added functions.

| Windows Logo Key Combination | Status            |
|------------------------------|-------------------|
| Windows + 1                  | reserved for OEMs |
| Windows + 2                  | reserved for OEMs |
| Windows + 3                  | reserved for OEMs |
| Windows + 4                  | reserved for OEMs |
| Windows + 5                  | reserved for OEMs |
| Windows + 6                  | reserved for OEMs |
| Windows + 7                  | reserved for OEMs |
| Windows + 8                  | reserved for OEMs |

|                                      |                                      |
|--------------------------------------|--------------------------------------|
| Windows + 9                          | reserved for OEMs                    |
| Windows + 0                          | reserved for OEMs                    |
| Windows + all other key combinations | <i>reserved for operating system</i> |

## Multiple Key Operation Requirements

### Valid 2-Key Combinations

The following list combined with the “Valid Final Keys” table, defines the valid 2-key combinations. When any one of the keys below is pressed, followed by a 2<sup>nd</sup> key from the “Valid Final Keys” table, the keyboard must properly indicate that those 2 keys are pressed. There are no exceptions to these 2-Key Combinations.

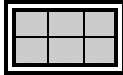
- LWIN
- RWIN
- LCTRL
- RCTRL
- LSHIFT
- RSHIFT
- LALT
- RALT

### Valid Final Keys

The following table lists the final keys that are required to work for valid two and three key combinations. Any key from the Valid 2-Key Combinations list combined with any key from the table below must work properly. Any 2 keys indicated in a row from the Valid 3-Key Combinations table combined with any key from the table below must work properly. Exceptions to this requirement are listed in Combinations of 3-Keys which are unavailable. Invalid key combinations will generate a Key Error code.

|     |     |           |              |
|-----|-----|-----------|--------------|
| Esc | Tab | c         | Left Arrow   |
| F1  | q   | v         | Right Arrow  |
| F2  | w   | b         | Up Arrow     |
| F3  | e   | n         | Down Arrow   |
| F4  | r   | m         |              |
| F6  | y   | .         | Enter        |
| F7  | u   | /         | Print Screen |
| F8  | i   | Insert    | Scroll Lock  |
| F9  | o   | Delete    | Pause        |
| F10 | p   | Home      | Num Lock     |
| F11 | [   | End       | Numeric 0    |
| F12 | ]   | Page Up   | Numeric 1    |
| `   | \   | Page Down | Numeric 2    |
| 1   | a   |           | Numeric 3    |
| 2   | s   |           | Numeric 4    |
| 3   | d   |           | Numeric 5    |
| 4   | f   |           | Numeric 6    |
| 5   | g   |           | Numeric 7    |
| 6   | h   |           | Numeric 8    |
| 7   | j   |           | Numeric 9    |
| 8   | k   |           | Numeric /    |
| 9   | l   |           | Numeric *    |
| 0   | ;   |           | Numeric -    |

|           |   |  |               |
|-----------|---|--|---------------|
| -         | ' |  | Numeric +     |
| =         | z |  | Numeric Enter |
| Backspace | x |  | Numeric .     |

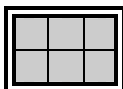


Indicates Traditional IBM Final keys.

### Valid 3-Key Combinations

The following table combined with the “Valid Final Keys” table, defines the valid 3-key combinations. For each row in the table below, an “X” indicates that key is selected. When the two keys in a row are pressed followed by a 3<sup>rd</sup> key from the “Valid Final Keys” table, the keyboard must properly indicate that those 3 keys are pressed. Exceptions to these tables are listed below. Any 3-key combinations not listed are not required to work, but may do so at the keyboard manufacturer’s discretion.

| LWIN | RWIN | LCTRL | RCTRL | LSHIFT | RSHIFT | LALT | RALT |
|------|------|-------|-------|--------|--------|------|------|
| X    |      |       |       |        |        |      |      |
| X    |      | X     |       |        |        |      |      |
| X    |      |       | X     |        |        |      |      |
| X    |      |       |       | X      |        |      |      |
| X    |      |       |       |        | X      |      |      |
| X    |      |       |       |        |        | X    |      |
| X    |      |       |       |        |        |      | X    |
|      | X    |       |       |        |        |      |      |
|      | X    | X     |       |        |        |      |      |
|      | X    |       | X     |        |        |      |      |
|      | X    |       |       | X      |        |      |      |
|      | X    |       |       |        | X      |      |      |
|      | X    |       |       |        |        | X    |      |
|      | X    |       |       |        |        |      | X    |
| X    | X    |       |       |        |        |      |      |
|      |      | X     |       | X      |        |      |      |
|      |      | X     |       |        | X      |      |      |
|      |      |       | X     | X      |        |      |      |
|      |      |       | X     |        | X      |      |      |
|      |      | X     |       |        |        | X    |      |
|      |      | X     |       |        |        |      | X    |
|      |      |       | X     |        |        | X    |      |
|      |      |       | X     |        |        |      | X    |
|      |      |       |       | X      |        | X    |      |
|      |      |       |       |        | X      | X    |      |
|      |      |       |       |        | X      |      | X    |



Indicates Traditional IBM 3-Key combinations.

### Combinations of 3-Keys which are Unavailable

Based upon the standard industry accepted 16 X 8 scanning matrix, several keys will be “ghosted”, meaning not uniquely detectable by the firmware during the key switch scanning of 3-Key combinations. To accommodate this, the following table details the key combinations, which are



excluded from the above tables. These 3-key combinations are not required to work, but may do so at the keyboard manufacturer's discretion.

| 1 <sup>st</sup> Key | 2 <sup>nd</sup> Key | 3 <sup>rd</sup> Key |
|---------------------|---------------------|---------------------|
| LWIN                | RWIN                | Up Arrow            |
|                     |                     |                     |
| RWIN                | LALT                | key 56              |
| RWIN                | RALT                | key 42              |
| RWIN                | RCTRL               | Caps Lock           |
| RWIN                | LCTRL               | Caps Lock           |
|                     |                     |                     |
| LWIN                | LALT                | key 107             |
|                     |                     |                     |
| LCTRL               | LSHIFT              | Pause, Caps Lock    |
| RCTRL               | RSHIFT              | Pause, Caps Lock    |

## *Additional General Requirements*

### *LWIN and RWIN Keys as modifiers*

This keyboard must generate unique scan codes for make and break. The LWIN and RWIN keys must be treated as modifier keys, much in the same way as ALT, and Control keys are handled today. It will be up to the operating system to decide on an implementation scheme for the modifier key functionality.

## *Building a Keyboard with the Windows Keys*

### *Tools Needed to Build a Keyboard with the Windows Keys*

- Keyboard Scan Code Specification (this document).
- Microsoft Windows Logo License Agreement
- Windows Logo Key License Agreement.
- Windows Exhibit A from the Device Testing Agreement.
- Windows Exhibit B from the "Designed for Microsoft" Logo License Agreement.
- Windows Keyboard Test Kit: Test Procedures and Test Tools.

### *How to Get the WHQL Keyboard Test Kit and Keys Specification*

The latest version of the Keyboard Scan Code Specification is available at <http://www.microsoft.com/hwdev/desinit/scancode.htm>.

The latest version of the WHQL Keyboard Test Kit is available electronically directly from the Windows Hardware Quality Labs Web Site at <http://www.microsoft.com/hwtest/testkits/>. You will need to individually download the Test Procedures and Test Tools document.

## *Microsoft Windows Legal Agreements*

Complete and sign the Microsoft Logo License Agreement and the Testing Agreement. If your company previously signed these agreements, you only need to include a newly completed "Exhibit A" of the Testing Agreement with your Test Submission.

**Note:** The following WHQL legal agreements, previously available through the Microsoft FAX Service, can now be downloaded from the WHQL web site at <http://www.microsoft.com/hwtest/testkits/> :

- Microsoft Windows Logo License Agreement - "Exhibit A5" (Windows Logo Agreement.tif)
- Testing Agreement (Testing Agreement.tif)
- "Exhibit A" of the Testing Agreement (Exhibit A.tif)

If you are unable to open these agreements, please send e-mail to [whqlinfo@microsoft.com](mailto:whqlinfo@microsoft.com) with **AGREEMENT REQUEST** in the Subject line.

Send blank e-mail to the auto reply at [whqlinfo@microsoft.com](mailto:whqlinfo@microsoft.com) for a complete list of administrative contacts.

## *Steps to Ship a Keyboard with the Windows Logo Keys*

Develop your keyboard according to the tables in Appendix A of this specification.

### *Compatibility Requirement*

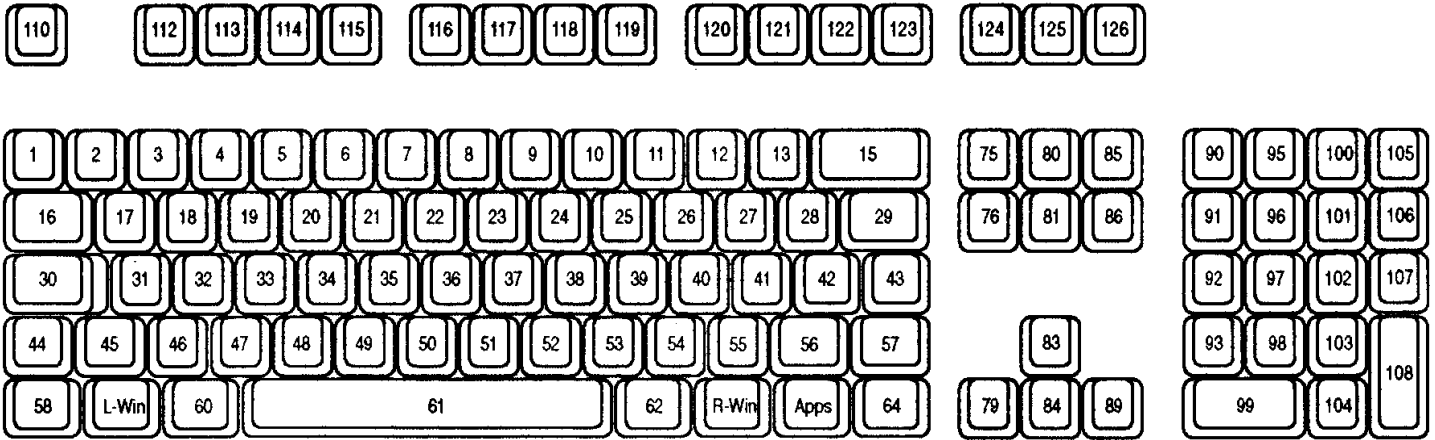
1. Keyboards are required to be compatible at the Windows virtual key code level. You can accomplish this by either:
  - a) Developing a keyboard with the electronics and firmware that comply with the specification or by,
  - b) Developing a software driver for use with Windows 3.1 and Windows 95 that maps the proper virtual key codes to keyboard events on your keyboard.
2. Test your implementation using the WHQL Keyboard Test Procedures to ensure that single-key, two-key and three-key combinations work correctly, including the Windows Logo keys (if implemented) and report the proper virtual scan codes in Windows.
3. Once you are satisfied that your keyboard passes the tests, run the full Test Suite and use it to generate log files of encoded test results that must be included with the other information required for your Test Submission. Full testing instructions are provided in the WHQL Keyboard Test Procedures.

### *Retest Requirements*

Any time that you implement the Windows Keys on a new keyboard technology, you must go through this testing and certification procedure. You will also need to submit a retest any time that you change the key layout or the BIOS firmware on a certified keyboard.

### *Recommended Physical Locations of the Windows Keys*

For full travel desktop keyboards Microsoft recommends that the Windows Logo keys be located near the current modifier keys like CTRL, SHIFT and ALT since the Windows Logo keys must also function as modifier keys. The Application key can be located wherever it appropriately fits. In the attached diagram the keys were placed on the bottom row on either side of the space bar. By changing the current size of the space bar the Windows Keys can be located in a similar position on a standard keyboard.



### Recommendations for Laptop Keyboards

Given the crowded nature of laptop keyboards it is difficult to add three Windows Keys. A minimal implementation of the Windows Keys would require the addition of one Windows Logo Key and the replacement of the [Fn] key for the Application key.

The two Windows Logo Keys are not distinguished individually by the Microsoft Windows 95 operating system and the IntelliType software only uses a Left Windows Logo key + Right Windows Logo key press for the Logon/Logoff function.

#### Design Requirements:

- The Windows Logo Key needs to function as a modifier key (CTRL, SHIFT and ALT).
- There can be no other icons or words associated with the Windows Flag trademark on the keycap.

#### Design Options:

- There do not need to be Left and Right Windows Logo keys to get full functionality in Windows 95.
- The Application key can be a dual function key and can be used to replace the Fn. key.

## ACPI Power Management Keys

The three ACPI Power Management keys report the following key codes in the Microsoft Windows 95, Windows 98, and Windows NT and operating systems.

### Key Codes for Scan Code Set 1:

| ACPI key    | Make  | Break | Windows Virtual Key |
|-------------|-------|-------|---------------------|
| Power Event | E0 5E | E0 DE | N/A                 |
| Sleep Event | E0 5F | E0 DF | N/A                 |
| Wake Event  | E0 63 | E0 E3 | N/A                 |

### Key Codes For Scan Code Set 2:

| ACPI key | Make | Break | Windows Virtual Key |
|----------|------|-------|---------------------|
|----------|------|-------|---------------------|

|             |       |          |     |
|-------------|-------|----------|-----|
| Power Event | E0 37 | E0 F0 37 | N/A |
| Sleep Event | E0 3F | E0 F0 3F | N/A |
| Wake Event  | E0 5E | E0 F0 5E | N/A |

### Key Codes for USB Usage Tables:

| ACPI Key    | Usage Page | Usage Index (Dec) | Usage Index (Hex) | Typical AT-101 position |
|-------------|------------|-------------------|-------------------|-------------------------|
| Power Event | 0x01       | 129               | 81                | N/A                     |
| Sleep Event | 0x01       | 130               | 82                | N/A                     |
| Wake Event  | 0x01       | 131               | 83                | N/A                     |

## Usage Page and Usages for Audio Control

A device wanting to be recognized as a HID audio control device must declare itself as being a **Consumer Control** device (usage 0x01), as defined in the **Consumer Page** (page 0x0C) in the *Universal Serial Bus HID Usage Tables Version 1.0 specification*. This means that its top-level application collection should be Usage Page (Consumer), Usage (Consumer Control).

When such a device is enumerated by the operating system, the supporting software (HIDSERVE.EXE) is installed and loaded on the host system. Table 1 outlines the Consumer Page audio controls that are supported in Windows 2000.

**Table 1. Consumer Page audio controls supported in Windows 2000.**

| Usage | Usage Name               | Usage Type               |
|-------|--------------------------|--------------------------|
| 0xE0  | <i>Volume*</i>           | Linear Control (LC)      |
| 0xE2  | <i>Mute*</i>             | On/Off Control (OOC)     |
| 0xE3  | Bass                     | Linear Control (LC)      |
| 0xE4  | Treble                   | Linear Control (LC)      |
| 0xE5  | <i>Bass Boost*</i>       | On/Off Control (OOC)     |
| 0xE7  | Loudness                 | On/Off Control (OOC)     |
| 0xE9  | <i>Volume Increment*</i> | Re-trigger Control (RTC) |
| 0xEA  | <i>Volume Decrement*</i> | Re-trigger Control (RTC) |
| 0x152 | Bass Increment           | Re-trigger Control (RTC) |
| 0x153 | Bass Decrement           | Re-trigger Control (RTC) |
| 0x154 | Treble Increment         | Re-trigger Control (RTC) |
| 0x155 | Treble Decrement         | Re-trigger Control (RTC) |

*\*) These controls are supported in Windows 98 (original release and Service Pack 1 release).*

The Volume, Bass, and Treble usages (of type LC) should be deployed for controls that generate both increment and decrement data represented by a 2-bit value, whereas the associated Increment and Decrement usages (of type RTC) should be deployed for pairs of one-bit controls (traditional button controls). The hardware design and implementation determines what usage types are appropriate for the HID firmware implementation for a particular device.

It's also important to notice that any re-triggering of events should be done by software timers in the host system, and not by hardware timers in the device itself. For example, if the user keeps pressing the Volume Increment button, the device should only generate one input report with this state information. Host software will perform the actual re-triggering of events that will lead to continuous increments of the volume until the device generates another input report indicating that the button has been released or until the maximum volume has been reached.

## *Important Design Aspects*

The supported HID audio controls:

- Affect audio playback only. There's no support for HID-based controls that affect audio recording, etc.
- Affect audio playback by the default system audio device (same device as sndvol32.exe controls).
- Should be declared right beneath the top-level application collection in the HID firmware in order to be discovered and utilized by the host system. Important: do not wrap these controls in sub-collections.

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## Sample Firmware Designs

The following two samples illustrate how firmware that uses the audio controls listed above can be implemented. The first sample uses the Volume usage (of type LC) for the volume control, and the second sample uses the Volume Increment and Volume Decrement usages (of type RTC). Notice that the mute button in both of these samples is implemented as a Relative, Preferred State type of control, or a toggle, which means that 0-to-1 transitions will toggle mute on/off.

### Sample 1.

```
Usage Page (Consumer)
Usage (Consumer Control)
Collection (Application)
  Usage (Volume)
  Logical Minimum (-1)
  Logical Maximum (1)
  Report Size (2)
  Report Count (1)
  Input (Data, Variable, Relative, Preferred)
  Usage (Mute)
  Logical Minimum (0)
  Logical Maximum (1)
  Report Size (1)
  Report Count (1)
  Input (Data, Variable, Relative, Preferred)
  Report Count (5)
  Input (Constant)
End Collection
```

### Sample 2.

```
Usage Page (Consumer)
Usage (Consumer Control)
Collection (Application)
  Logical Minimum (0)
  Logical Maximum (1)
  Usage (Volume Increment)
  Usage (Volume Decrement)
  Report Size (1)
  Report Count (2)
  Input (Data, Variable, Absolute, Preferred)
  Usage (Mute)
  Report Count (1)
  Input (Data, Variable, Relative, Preferred)
  Report Count (5)
  Input (Constant)
End Collection
```

---

## Appendix A: Windows Standard PS/2 Scan Codes

### General Requirements

This keyboard must be downward compatible with an enhanced type 101 keyboard. This keyboard must be fully compatible with the PS/2 Keyboard Controller command set. It must support Scan Set 2. Three additional scan codes are to be generated from the three Windows Keys (Left Windows, Right Windows, and Application).

The virtual key codes described in the following tables are specifically for Windows operation only and are not generated by the keyboard directly. The keyboard manufacturer will need to provide a Windows Logo keyboard driver to support the three virtual keys for use with the Windows v. 3.1 operating system (not required for Logo purposes). The support will be built into drivers shipped with future versions of the Windows and Windows NT operating systems.

### Typematic Characteristics

Typematic is the term used for keys that will automatically repeat after a specified time delay. In scan code 1 and scan code 2, key 126 is the only key that is not Typematic. (This key is the only one that does not send a break code as well).

### Scan Code Assignments:

Under all Microsoft operating systems, all keyboards actually transmit Scan Code Set 2 values down the wire from the keyboard to the keyboard port. These values are translated to Scan Code Set 1 by the i8042 port chip.<sup>1</sup> The rest of the operating system, and all applications that handle scan codes expect the values to be from Scan Code Set 1. Scan Code Set 3 is not used or required for operation of Microsoft operating systems.

The following recommendations are made for those who wish to define a new scan code for a proprietary purpose. It is the manufacturer's responsibility to implement a software driver that supports any such scan codes. New scan codes must not be chosen from those currently recognized by the operating system. Keys that are called out with a Key Number or Key Name in the Scan Code Table are currently recognized by and used by the operating system.

### Single-Byte Scan Codes

The values discussed below are all Scan Code Set 1 values.

**Avoid Set 1 scan codes above 0x79**, since the release (key up) code would be 0xFA or greater, and the keyboard driver is known to interpret such values as responses from the 8042 chip, not as keystrokes (scan codes). Specifically, 0x7A, 0x7E and 0x7F are problematic for the Windows NT keyboard driver in 3.51 and 4.0 since 0xFE is RESEND, 0xFA is ACKNOWLEDGE and 0xFF seems to be simply just swallowed up. The effect is that key releases would be lost, and error logs fill up.

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<sup>1</sup> This mode is set by issuing a 0xF0 command byte to the keyboard, and turning the translate bit (0x40) in the 8042 command byte on. On Intel and Power PC machines, it is the firmware that initializes the keyboard and 8042 chip this way, while Windows NT® explicitly sets this mode for MIPS and Alpha.

In the very early days of Windows NT®, an attempt was made to use the much more orthogonal Scan Code Set 3, but due to bugs in the implementation of this Scan Code Set on numerous OEM keyboards, the idea was abandoned.

- **Avoid 0x60 and 0x61**, since the release (up key) code would be 0xE0 and 0xE1, which are reserved prefix bytes.
- **Avoid 0x00**, since that is likely to have some special meaning to code from driver level through to application level.

### Prefixed Scan Codes

Some keys on standard 101/102-key keyboards (and the Microsoft Natural keyboard amongst others) emit a sequence of two bytes, where the 1<sup>st</sup> byte is either 0xE0 or 0xE1. This method is used primarily to distinguish between left and right versions of the same key, e.g., Left Alt is 0x38 while Right Alt is 0xE0 0x38. The 0xE0 prefix is indicated as the “extended bit” (bit 24) in the IParam of messages such as WM\_KEYDOWN. The 0xE1 prefix is much rarer, but operates similarly to the 0xE0 prefix. It’s presence or absence is not indicated through the API in any way.

If you use scan codes from the 0xE0 set, make sure the second byte is suitable in the same way as single byte scan code values. In other words:

Not greater than 0x79

Not 0x60 or 0x61

Not 0x00

### Scan Code Table

The following table lists the full set of Scan Codes as presently recognized by the Microsoft operating systems. The US Key assignments are for reference to a type 101/102 Enhanced keyboard as supported by the Type 4 Keyboard layout. If there is no entry in the 101/102 Enhanced keyboard column, this scan code is currently not recognized by the operating system. The Key Location field has been added to aid in the placement of keys as illustrated in the Recommended Physical Locations of the Windows Keys on page 10.

| key location | 101/102 Enhanced Keyboard | scan 1 make | scan 1 break | scan 2 make | scan 2 brake |
|--------------|---------------------------|-------------|--------------|-------------|--------------|
|              | DO NOT USE                | 00          | 80           | 00          | F0 00        |
|              | DO NOT USE                | E0_00       | E0_80        | E0_00       | E0_F0 00     |
| 1            | ~ `                       | 29          | A9           | 0E          | F0 0E        |
|              |                           | E0_29       | E0_A9        | E0_0E       | E0_F0 0E     |
| 2            | ! 1                       | 02          | 82           | 16          | F0 16        |
|              |                           | E0_02       | E0_82        | E0_16       | E0_F0 16     |
| 3            | @ 2                       | 03          | 83           | 1E          | F0 1E        |
|              |                           | E0_03       | E0_83        | E0_1E       | E0_F0 1E     |
| 4            | # 3                       | 04          | 84           | 26          | F0 26        |
|              |                           | E0_04       | E0_84        | E0_26       | E0_F0 26     |
| 5            | \$ 4                      | 05          | 85           | 25          | F0 25        |
|              |                           | E0_05       | E0_85        | E0_25       | E0_F0 25     |
| 6            | % 5                       | 06          | 86           | 2E          | F0 2E        |
|              |                           | E0_06       | E0_86        | E0_2E       | E0_F0 2E     |
| 7            | ^ 6                       | 07          | 87           | 36          | F0 36        |
|              |                           | E0_07       | E0_87        | E0_36       | E0_F0 36     |
| 8            | & 7                       | 08          | 88           | 3D          | F0 3D        |
|              |                           | E0_08       | E0_88        | E0_3D       | E0_F0 3D     |
| 9            | * 8                       | 09          | 89           | 3E          | F0 3E        |
|              |                           | E0_09       | E0_89        | E0_3E       | E0_F0 3E     |
| 10           | ( 9                       | 0A          | 8A           | 46          | F0 46        |
|              |                           | E0_0A       | E0_8A        | E0_46       | E0_F0 46     |
| 11           | ) 0                       | 0B          | 8B           | 45          | F0 45        |
|              |                           | E0_0B       | E0_8B        | E0_45       | E0_F0 45     |
| 12           | _ -                       | 0C          | 8C           | 4E          | F0 4E        |



| key location | 101/102 Enhanced Keyboard | scan 1 make | scan 1 break | scan 2 make | scan 2 brake |
|--------------|---------------------------|-------------|--------------|-------------|--------------|
|              |                           | E0_0C       | E0_8C        | E0_4E       | E0_F0 4E     |
| 13           | + =                       | 0D          | 8D           | 55          | F0 55        |
|              |                           | E0_0D       | E0_8D        | E0_55       | E0_F0 55     |
| 15           | Backspace                 | 0E          | 8E           | 66          | F0 66        |
|              |                           | E0_0E       | E0_8E        | E0_66       | E0_F0 66     |
| 16           | Tab                       | 0F          | 8F           | 0D          | F0 0D        |
|              |                           | E0_0F       | E0_8F        | E0_0D       | E0_F0 0D     |
| 17           | Q                         | 10          | 90           | 15          | F0 15        |
|              |                           | E0_10       | E0_90        | E0_15       | E0_F0 15     |
| 18           | W                         | 11          | 91           | 1D          | F0 1D        |
|              |                           | E0_11       | E0_91        | E0_1D       | E0_F0 1D     |
| 19           | E                         | 12          | 92           | 24          | F0 24        |
|              |                           | E0_12       | E0_92        | E0_24       | E0_F0 24     |
| 20           | R                         | 13          | 93           | 2D          | F0 2D        |
|              |                           | E0_13       | E0_93        | E0_2D       | E0_F0 2D     |
| 21           | T                         | 14          | 94           | 2C          | F0 2C        |
|              |                           | E0_14       | E0_94        | E0_2C       | E0_F0 2C     |
| 22           | Y                         | 15          | 95           | 35          | F0 35        |
|              |                           | E0_15       | E0_95        | E0_35       | E0_F0 35     |
| 23           | U                         | 16          | 96           | 3C          | F0 3C        |
|              |                           | E0_16       | E0_96        | E0_3C       | E0_F0 3C     |
| 24           | I                         | 17          | 97           | 43          | F0 43        |
|              |                           | E0_17       | E0_97        | E0_43       | E0_F0 43     |
| 25           | O                         | 18          | 98           | 44          | F0 44        |
|              |                           | E0_18       | E0_98        | E0_44       | E0_F0 44     |
| 26           | P                         | 19          | 99           | 4D          | F0 4D        |
|              |                           | E0_19       | E0_99        | E0_4D       | E0_F0 4D     |
| 27           | { [                       | 1A          | 9A           | 54          | F0 54        |
|              |                           | E0_1A       | E0_9A        | E0_54       | E0_F0 54     |
| 28           | } ]                       | 1B          | 9B           | 5B          | F0 5B        |
|              |                           | E0_1B       | E0_9B        | E0_5B       | E0_F0 5B     |
| 29*          | \                         | 2B          | AB           | 5D          | F0 5D        |
|              |                           | E0_2B       | E0_AB        | E0_5D       | E0_F0 5D     |
| 30           | Caps Lock                 | 3A          | BA           | 58          | F0 58        |
|              |                           | E0_3A       | E0_BA        | E0_58       | E0_F0 58     |
| 31           | A                         | 1E          | 9E           | 1C          | F0 1C        |
|              |                           | E0_1E       | E0_9E        | E0_1C       | E0_F0 1C     |
| 32           | S                         | 1F          | 9F           | 1B          | F0 1B        |
|              |                           | E0_1F       | E0_9F        | E0_1B       | E0_F0 1B     |
| 33           | D                         | 20          | A0           | 23          | F0 23        |
|              |                           | E0_20       | E0_A0        | E0_23       | E0_F0 23     |
| 34           | F                         | 21          | A1           | 2B          | F0 2B        |
|              |                           | E0_21       | E0_A1        | E0_2B       | E0_F0 2B     |
| 35           | G                         | 22          | A2           | 34          | F0 34        |
|              |                           | E0_22       | E0_A2        | E0_34       | E0_F0 34     |
| 36           | H                         | 23          | A3           | 33          | F0 33        |
|              |                           | E0_23       | E0_A3        | E0_33       | E0_F0 33     |
| 37           | J                         | 24          | A4           | 3B          | F0 3B        |
|              |                           | E0_24       | E0_A4        | E0_3B       | E0_F0 3B     |
| 38           | K                         | 25          | A5           | 42          | F0 42        |
|              |                           | E0_25       | E0_A5        | E0_42       | E0_F0 42     |
| 39           | L                         | 26          | A6           | 4B          | F0 4B        |
|              |                           | E0_26       | E0_A6        | E0_4B       | E0_F0 4B     |
| 40           | : ;                       | 27          | A7           | 4C          | F0 4C        |
|              |                           | E0_27       | E0_A7        | E0_4C       | E0_F0 4C     |
| 41           | “ ‘                       | 28          | A8           | 52          | F0 52        |
|              |                           | E0_28       | E0_A8        | E0_52       | E0_F0 52     |
| 42**         |                           | 2B          | AB           | 5D          | F0 5D        |
|              |                           | E0_2B       | E0_AB        | E0_5D       | E0_F0 5D     |
| 43           | Enter                     | 1C          | 9C           | 5A          | F0 5A        |
| 44           | L SHIFT                   | 2A          | AA           | 12          | F0 12        |
|              |                           | E0_2A       | E0_AA        | E0_12       | E0_F0 12     |

| key location | 101/102 Enhanced Keyboard | scan 1 make | scan 1 break | scan 2 make | scan 2 brake |
|--------------|---------------------------|-------------|--------------|-------------|--------------|
| 45**         |                           | 56          | D6           | 61          | F0 61        |
|              |                           | E0_56       | E0_D6        | E0_61       | E0_F0 61     |
| 46           | Z                         | 2C          | AC           | 1A          | F0 1A        |
|              |                           | E0_2C       | E0_AC        | E0_1A       | E0_F0 1A     |
| 47           | X                         | 2D          | AD           | 22          | F0 22        |
|              |                           | E0_2D       | E0_AD        | E0_22       | E0_F0 22     |
| 48           | C                         | 2E          | AE           | 21          | F0 21        |
|              |                           | E0_2E       | E0_AE        | E0_21       | E0_F0 21     |
| 49           | V                         | 2F          | AF           | 2A          | F0 2A        |
|              |                           | E0_2F       | E0_AF        | E0_2A       | E0_F0 2A     |
| 50           | B                         | 30          | B0           | 32          | F0 32        |
|              |                           | E0_30       | E0_B0        | E0_32       | E0_F0 32     |
| 51           | N                         | 31          | B1           | 31          | F0 31        |
|              |                           | E0_31       | E0_B1        | E0_31       | E0_F0 31     |
| 52           | M                         | 32          | B2           | 3A          | F0 3A        |
|              |                           | E0_32       | E0_B2        | E0_3A       | E0_F0 3A     |
| 53           | < ,                       | 33          | B3           | 41          | F0 41        |
|              |                           | E0_33       | E0_B3        | E0_41       | E0_F0 41     |
| 54           | > .                       | 34          | B4           | 49          | F0 49        |
|              |                           | E0_34       | E0_B4        | E0_49       | E0_F0 49     |
| 55           | ? /                       | 35          | B5           | 4A          | F0 4A        |
|              |                           | E0_35       | E0_B5        | E0_4A       | E0_F0 4A     |
| 56***        |                           | 73          | F3           | 51          | F0 51        |
|              |                           | E0_73       | E0_F3        | E0_51       | E0_F0 51     |
| 57           | R SHIFT                   | 36          | B6           | 59          | F0 59        |
|              |                           | E0_36       | E0_B6        | E0_59       | E0_F0 59     |
| 58           | L CTRL                    | 1D          | 9D           | 14          | F0 14        |
| 60           | L ALT                     | 38          | B8           | 11          | F0 11        |
|              |                           | E0_38       | E0_B8        | E0_11       | E0_F0 11     |
| 61           | Space Bar                 | 39          | B9           | 29          | F0 29        |
|              |                           | E0_39       | E0_B9        | E0_29       | E0_F0 29     |
| 62           | R ALT                     | E0 38       | E0 B8        | E0 11       | E0 F0 11     |
| 64           | R CTRL                    | E0 1D       | E0 9D        | E0 14       | E0 F0 14     |
| 75           | Insert                    | Note 1      | Note 1       | Note 2      | Note 2       |
| 76           | Delete                    | Note 1      | Note 1       | Note 2      | Note 2       |
| 79           | L Arrow                   | Note 1      | Note 1       | Note 2      | Note 2       |
| 80           | Home                      | Note 1      | Note 1       | Note 2      | Note 2       |
| 81           | End                       | Note 1      | Note 1       | Note 2      | Note 2       |
| 83           | Up Arrow                  | Note 1      | Note 1       | Note 2      | Note 2       |
| 84           | Dn Arrow                  | Note 1      | Note 1       | Note 2      | Note 2       |
| 85           | Page Up                   | Note 1      | Note 1       | Note 2      | Note 2       |
| 86           | Page Down                 | Note 1      | Note 1       | Note 2      | Note 2       |
| 89           | R Arrow                   | Note 1      | Note 1       | Note 2      | Note 2       |
| 90           | Num Lock                  | 45          | C5           | 77          | F0 77        |
|              |                           | E0_45       | E0_C5        | E0_77       | E0_F0 77     |
| 91           | Numeric 7                 | 47          | C7           | 6C          | F0 6C        |
| 92           | Numeric 4                 | 4B          | CB           | 6B          | F0 6B        |
| 93           | Numeric 1                 | 4F          | CF           | 69          | F0 69        |
| 95           | Numeric /                 | Note 3      | Note 3       | Note 3      | Note 3       |
| 96           | Numeric 8                 | 48          | C8           | 75          | F0 75        |
| 97           | Numeric 5                 | 4C          | CC           | 73          | F0 73        |
| 98           | Numeric 2                 | 50          | D0           | 72          | F0 72        |
| 99           | Numeric 0                 | 52          | D2           | 70          | F0 70        |
| 100          | Numeric *                 | 37          | B7           | 7C          | F0 7C        |
|              |                           | E0_37       | E0_B7        | E0_7C       | E0_F0 7C     |
| 101          | Numeric 9                 | 49          | C9           | 7D          | F0 7D        |
| 102          | Numeric 6                 | 4D          | CD           | 74          | F0 74        |
| 103          | Numeric 3                 | 51          | D1           | 7A          | F0 7A        |
| 104          | Numeric .                 | 53          | D3           | 71          | F0 71        |
| 105          | Numeric -                 | 4A          | CA           | 7B          | F0 7B        |
| 106          | Numeric +                 | 4E          | CE           | 79          | F0 79        |
| 107***       |                           | 7E          | FE           | 6D          | F0 6D        |

| key location | 101/102 Enhanced Keyboard | scan 1 make | scan 1 break | scan 2 make | scan 2 brake |
|--------------|---------------------------|-------------|--------------|-------------|--------------|
|              | DO NOT USE                | E0_7E       | E0_FE        | E0_6D       | E0_F0 6D     |
| 108          | Numeric Enter             | E0_1C       | E0_9C        | E0_5A       | E0_F0 5A     |
| 110          | Esc                       | 01          | 81           | 76          | F0 76        |
|              |                           | E0_01       | E0_81        | E0_76       | E0_F0 76     |
| 112          | F1                        | 3B          | BB           | 05          | F0 05        |
|              |                           | E0_3B       | E0_BB        | E0_05       | E0_F0 05     |
| 113          | F2                        | 3C          | BC           | 06          | F0 06        |
|              |                           | E0_3C       | E0_BC        | E0_06       | E0_F0 06     |
| 114          | F3                        | 3D          | BD           | 04          | F0 05        |
|              |                           | E0_3D       | E0_BD        | E0_04       | E0_F0 05     |
| 115          | F4                        | 3E          | BE           | 0C          | F0 0C        |
|              |                           | E0_3E       | E0_BE        | E0_0C       | E0_F0 0C     |
| 116          | F5                        | 3F          | BF           | 03          | F0 03        |
|              |                           | E0_3F       | E0_BF        | E0_03       | E0_F0 03     |
| 117          | F6                        | 40          | C0           | 0B          | F0 0B        |
|              |                           | E0_40       | E0_C0        | E0_0B       | E0_F0 0B     |
| 118          | F7                        | 41          | C1           | 83          | F0 83        |
|              |                           | E0_41       | E0_C1        | E0_83       | E0_F0 83     |
| 119          | F8                        | 42          | C2           | 0A          | F0 0A        |
|              |                           | E0_42       | E0_C2        | E0_0A       | E0_F0 0A     |
| 120          | F9                        | 43          | C3           | 01          | F0 01        |
|              |                           | E0_43       | E0_C3        | E0_01       | E0_F0 01     |
| 121          | F10                       | 44          | C4           | 09          | F0 09        |
|              |                           | E0_44       | E0_C4        | E0_09       | E0_F0 09     |
| 122          | F11                       | 57          | D7           | 78          | F0 78        |
| 123          | F12                       | 58          | D8           | 07          | F0 07        |
| 124          | Print Screen              | Note 4      | Note 4       | Note 4      | Note 4       |
| 125          | Scroll Lock               | 46          | C6           | 7E          | F0 7E        |
|              |                           | E0_46       | E0_C6        | E0_7E       | E0_F0 7E     |
| 126          | Pause                     | Note 5      | Note 5       | Note 5      | Note 5       |
|              |                           | 59          | D9           | 0F          | F0 0F        |
|              |                           | E0_59       | E0_D9        | E0_0F       | E0_F0 0F     |
|              |                           | 5B          | DB           | 1F          | F0 1F        |
|              | Left Win                  | E0_5B       | E0_DB        | E0_1F       | E0_F0 1F     |
|              |                           | 5C          | DC           | 27          | F0 27        |
|              | Right Win                 | E0_5C       | E0_DC        | E0_27       | E0_F0 27     |
|              |                           | 5D          | DD           | 2F          | F0 2F        |
|              | Application               | E0_5D       | E0_DD        | E0_2F       | E0_F0 2F     |
|              |                           | 5E          | DE           | 37          | F0 37        |
|              | ACPI Power                | E0_5E       | E0_DE        | E0_37       | E0_F0 37     |
|              |                           | 5F          | DF           | 3F          | F0 3F        |
|              | ACPI Sleep                | E0_5F       | E0_DF        | E0_3F       | E0_F0 3F     |
|              | DO NOT USE                | 60          | E0           | 47          | F0 47        |
|              | DO NOT USE                | E0_60       | E0_E0        | E0_47       | E0_F0 47     |
|              | DO NOT USE                | 61          | E1           | 4F          | F0 4F        |
|              | DO NOT USE                | E0_61       | E0_E1        | E0_4F       | E0_F0 4F     |
|              |                           | 62          | E2           | 56          | F0 56        |
|              |                           | E0_62       | E0_E2        | E0_56       | E0_F0 56     |
|              |                           | 63          | E3           | 5E          | F0 5E        |
|              | ACPI Wake                 | E0_63       | E0_E3        | E0_5E       | E0_F0 5E     |
|              |                           | 64          | E4           | 08          | F0 08        |
|              |                           | E0_64       | E0_E4        | E0_08       | E0_F0 08     |
|              |                           | 65          | E5           | 10          | F0 10        |
|              |                           | E0_65       | E0_E5        | E0_10       | E0_F0 10     |
|              |                           | 66          | E6           | 18          | F0 18        |
|              |                           | E0_66       | E0_E6        | E0_18       | E0_F0 18     |
|              |                           | 67          | E7           | 20          | F0 20        |
|              |                           | E0_67       | E0_E7        | E0_20       | E0_F0 20     |
|              |                           | 68          | E8           | 28          | F0 28        |
|              |                           | E0_68       | E0_E8        | E0_28       | E0_F0 28     |
|              |                           | 69          | E9           | 30          | F0 30        |
|              |                           | E0_69       | E0_E9        | E0_30       | E0_F0 30     |

| key location | 101/102 Enhanced Keyboard | scan 1 make | scan 1 break | scan 2 make | scan 2 brake |
|--------------|---------------------------|-------------|--------------|-------------|--------------|
|              |                           | 6A          | EA           | 38          | F0 38        |
|              |                           | E0_6A       | E0_EA        | E0_38       | E0_F0 38     |
|              |                           | 6B          | EB           | 40          | F0 40        |
|              |                           | E0_6B       | E0_EB        | E0_40       | E0_F0 40     |
|              |                           | 6C          | EC           | 48          | F0 48        |
|              |                           | E0_6C       | E0_EC        | E0_48       | E0_F0 48     |
|              |                           | 6D          | ED           | 50          | F0 50        |
|              |                           | E0_6D       | E0_ED        | E0_50       | E0_F0 50     |
|              |                           | 6E          | EE           | 57          | F0 57        |
|              |                           | E0_6E       | E0_EE        | E0_57       | E0_F0 57     |
|              |                           | 6F          | EF           | 6F          | F0 6F        |
|              |                           | E0_6F       | E0_EF        | E0_6F       | E0_F0 6F     |
|              | DBE_KATAKANA‡             | 70          | F0           | 13          | F0 13        |
|              |                           | E0_70       | E0_F0        | E0_13       | E0_F0 13     |
|              |                           | 71          | F1           | 19          | F0 19        |
|              |                           | E0_71       | E0_F1        | E0_19       | E0_F0 19     |
|              |                           | 72          | F2           | 39          | F0 39        |
|              |                           | E0_72       | E0_F2        | E0_39       | E0_F0 39     |
|              |                           | 74          | F4           | 53          | F0 53        |
|              |                           | E0_74       | E0_F4        | E0_53       | E0_F0 53     |
|              |                           | 75          | F5           | 5C          | F0 5C        |
|              |                           | E0_75       | E0_F5        | E0_5C       | E0_F0 5C     |
|              |                           | 76          | F6           | 5F          | F0 5F        |
|              |                           | E0_76       | E0_F6        | E0_5F       | E0_F0 5F     |
|              | DBE_SBCSCHAR‡             | 77          | F7           | 62          | F0 62        |
|              |                           | E0_77       | E0_F7        | E0_62       | E0_F0 62     |
|              |                           | 78          | F8           | 63          | F0 63        |
|              |                           | E0_78       | E0_F8        | E0_63       | E0_F0 63     |
|              | CONVERT‡                  | 79          | F9           | 64          | F0 64        |
|              |                           | E0_79       | E0_F9        | E0_64       | E0_F0 64     |
|              | DO NOT USE                | 7A          | FA           | 65          | F0 65        |
|              | DO NOT USE                | E0_7A       | E0_FA        | E0_65       | E0_F0 65     |
|              | NONCONVERT‡               | 7B          | FB           | 67          | F0 67        |
|              | DO NOT USE                | E0_7B       | E0_FB        | E0_67       | E0_F0 67     |
|              | DO NOT USE                | 7C          | FC           | 68          | F0 68        |
|              | DO NOT USE                | E0_7C       | E0_FC        | E0_68       | E0_F0 68     |
|              | DO NOT USE                | 7D          | FD           | 6A          | F0 6A        |
|              | DO NOT USE                | E0_7D       | E0_FD        | E0_6A       | E0_F0 6A     |
|              | DO NOT USE                | 7F          | FF           | 6E          | F0 6E        |
|              | DO NOT USE                | E0_7F       | E0_FF        | E0_6E       | E0_F0 6E     |

Note \* Key 29 is available on the US and not on the International Keyboard.

Note \*\* Keys 42 and 45 are available on the International Keyboard and not on the US Keyboard.

Note \*\*\* Keys 56 and 107 are used on Brazilian and some Far East keyboards. They not available on US Keyboards.

Note ‡ Keys are used for Far East keyboards.

**Note 1 for Scan Code 1:**

These keys may have additional “shift” and/or “unshift” scan codes preceding the **Base Make** code and following the **Base Break** code, depending upon the current state of **Num Lock** and the state of **Shift** key/s (when multiple keys are held down at the same time).

These Keys are Typematic:

| Key Location | US key assignment | Base Make | Base Break |
|--------------|-------------------|-----------|------------|
| 75           | Insert            | E0 52     | E0 D2      |

|    |             |       |       |
|----|-------------|-------|-------|
| 76 | Delete      | E0 53 | E0 D3 |
| 79 | Left Arrow  | E0 4B | E0 CB |
| 80 | Home        | E0 47 | E0 C7 |
| 81 | End         | E0 4F | E0 CF |
| 83 | Up Arrow    | E0 48 | E0 C8 |
| 84 | Dn Arrow    | E0 50 | E0 D0 |
| 85 | Page Up     | E0 49 | E0 C9 |
| 86 | Page Down   | E0 51 | E0 D1 |
| 89 | Right Arrow | E0 4D | E0 CD |

| Num Lock ON                             | Precede Base Make code with | follow Base Break code with |
|---|-----------------------------|-----------------------------|
| Final Key only                          | E0 2A                       | E0 AA                       |
| LSHIFT down + Final Key                 |                             |                             |
| RSHIFT down + Final Key                 |                             |                             |
| Both LSHIFT and RSHIFT down + Final Key |                             |                             |

| Num Lock OFF                            | Precede Base Make code with | follow Base Break code with |
|---|-----------------------------|-----------------------------|
| Final Key only                          |                             |                             |
| LSHIFT down + Final Key                 | E0 AA                       | E0 2A                       |
| RSHIFT down + Final Key                 | E0 B6                       | E0 36                       |
| Both LSHIFT and RSHIFT down + Final Key | E0 AA E0 B6                 | E0 36 E0 2A                 |

As an example, consider the case where **Num Lock** is **OFF** and you choose to push and hold **Left SHIFT**, then push and hold **Right SHIFT**, and finally push **Insert**. The scan codes sent would be:

2A (LSHIFT make)  
 36 (RSHIFT make)  
 E0 AA E0 B6 E0 52 (Insert make)

When these keys are released, the keys still held down at the time a key is released determine it's scan code. Assume **Insert** is released first then **Right SHIFT** and last **Left SHIFT**. The scan codes would be:

E0 D2 E0 36 E0 2A (Insert break)  
 B6 (RSHIFT break)  
 AA (LSHIFT break)

**Note 2 for Scan Code 2:**

These keys may have additional "shift" and/or "unshift" scan codes preceding the **Base Make** code and following the **Base Break** code, depending upon the current state of **Num Lock** and the state of **SHIFT** key/s (when multiple keys are held down at the same time).

These Keys are Typematic

| key location | US key assignment | Base Make | Base Break |
|--------------|-------------------|-----------|------------|
| 75           | Insert            | E0 70     | E0 F0 70   |
| 76           | Delete            | E0 71     | E0 F0 71   |
| 79           | Left Arrow        | E0 6B     | E0 F0 6B   |
| 80           | Home              | E0 6C     | E0 F0 6C   |

|    |             |       |          |
|----|-------------|-------|----------|
| 81 | End         | E0 69 | E0 F0 69 |
| 83 | Up Arrow    | E0 75 | E0 F0 75 |
| 84 | Dn Arrow    | E0 72 | E0 F0 72 |
| 85 | Page Up     | E0 7D | E0 F0 7D |
| 86 | Page Down   | E0 7A | E0 F0 7A |
| 89 | Right Arrow | E0 74 | E0 F0 74 |

| Num Lock ON                             | Precede Base Make code with | follow Base Break code with |
|---|-----------------------------|-----------------------------|
| Final Key only                          | E0 12                       | E0 F0 12                    |
| LSHIFT down + Final Key                 |                             |                             |
| RSHIFT down + Final Key                 |                             |                             |
| Both LSHIFT and RSHIFT down + Final Key |                             |                             |

| Num Lock OFF                            | Precede Base Make code with | follow Base Break code with |
|---|-----------------------------|-----------------------------|
| Final Key only                          |                             |                             |
| LSHIFT down + Final Key                 | E0 F0 12                    | E0 12                       |
| RSHIFT down + Final Key                 | E0 F0 59                    | E0 59                       |
| Both LSHIFT and RSHIFT down + Final Key | E0 F0 12 E0 F0 59           | E0 59 E0 12                 |

*Note 3 Key 95 for Scan Codes 1 and 2:*  
 This Key is Typematic (Numeric / on US keyboards)

| Scan Code | base     | L-SHIFT + base | R-SHIFT + base | L-SHIFT + R-SHIFT + base |
|-----------|----------|----------------|----------------|--------------------------|
| 1 make    | E0 35    | E0 AA E0 35    | E0 B6 E0 35    | E0 AA E0 B6 E0 35        |
| 1 break   | E0 B5    | E0 B5 E0 2A    | E0 B5 E0 36    | E0 B5 E0 36 E0 2A        |
| 2 make    | E0 4A    | E0 F0 12 E0 4A | E0 F0 59 E0 4A | E0 F0 12 E0 F0 59 E0 4A  |
| 2 break   | E0 F0 4A | E0 F0 4A E0 12 | E0 F0 4A E0 59 | E0 F0 4A E0 59 E0 12     |

*Note 4 Key 124 for Scan Codes 1 and 2:*  
 This Key is Typematic (Print Screen on US keyboards)

| Scan Code | Make        | Break             | L Ctrl or R Ctrl + LSHIFT or RSHIFT + Make | L Ctrl or R Ctrl + LSHIFT or RSHIFT + Break | L Alt or R Alt + Make | L Alt or R Alt + Break |
|-----------|-------------|-------------------|--|---|-----------------------|------------------------|
| 1         | E0 2A E0 37 | E0 B7 E0 AA       | E0 37                                      | E0 B7                                       | 54                    | D4                     |
| 2         | E0 12 E0 7C | E0 F0 7C E0 F0 12 | E0 7C                                      | E0 F0 7C                                    | 84                    | F0 84                  |

*Note 5 Key 126 for Scan Codes 1 and 2:*  
 This Key is not Typematic and has no Break Code (Pause on US keyboards)

| Scan Code | Make | L-Ctrl or R-Ctrl + Make |
|-----------|------|-------------------------|
|-----------|------|-------------------------|

|   |                         |                |
|---|-------------------------|----------------|
| 1 | E1 1D 45 E1 9D C5       | E0 46 E0 C6    |
| 2 | E1 14 77 E1 F0 14 F0 77 | E0 7E E0 F0 7E |

## *Additional General Requirements*

### *Power On Reset Routine*

During a Power On Reset condition, this keyboard must perform a self-test and respond with a diagnostic completion code (AA for pass, otherwise return an error code). Completion codes must be sent within 450 msec and 2.5 seconds after the Power On Reset. After Reset, this keyboard defaults to Scan Code Set 2.

### *Reset Command*

Upon receiving a FF (soft Reset command) from the host, this keyboard responds with a completion code, within 300 and 500 msec after acknowledging the Reset command.

### *Keyboard Command Acknowledge*

All keyboard commands are acknowledged with an FA (ACK) or FE (Re-send). The Acknowledge response time must be within 20 msec.

---

## Appendix B: Device Class Power Management v1.0a

### Scope

This specification defines the behavior of the input device class as it relates to power management, and, specifically, to the four device power states defined for the OnNow Architecture. This specification applies to standard types of input devices such as keyboards, keypads, mice, pointing devices, joysticks, game pads, to devices that combine these kinds of input functionality (composite devices, etc.), and to new types of input devices such as virtual reality devices, simulation devices, etc. It is intended that input device vendors will be able to design consistent power-manageable products, and that OS vendors will be able to implement an appropriate input device power management policy based on the contents of this specification.

### General Device Power Management Considerations

In the OnNow architecture, power management of individual devices is the responsibility of a policy owner in the operating system, generally a class-specific driver. This policy-owner will implement a power conservation policy that is appropriate for devices in its class. The policy will operate in conjunction with a global system power policy implemented in the operating system (i.e., is the system Working or Sleeping?). In general, the device-class power conservation policy strives to reduce power consumption while the system is Working by transitioning amongst various available power states according to device usage.

Since the policy-owner in the operating system has very specific knowledge of when a device is in use, or potentially in use, there is no need for hardware timers or such to determine when to make these transitions. Similarly, this level of understanding of device usage makes it possible to use fewer device power states. Generally, intermediate states attempt to draw a compromise between latency and consumption due to the uncertainty of actual device usage. With the increased knowledge in the OS, crisp decisions can be made about whether the device is needed at all. With this ability to turn devices off more frequently, the benefit of having intermediate states diminishes.

The policy-owner also determines what class-specific events can cause the system to transition from Sleeping to Working, and enables this functionality based on application or user requests. Note that the definition of the wake-up events that each class supports will influence the system's global power policy in terms of the level of power conservation the Sleeping state can attain while still meeting wake-up latency requirements set by applications or the user.

In the OnNow architecture, bus drivers also implement power policy for their bus class (e.g. PCI, USB, etc.). In general, the Bus driver has responsibility for tracking the device power states of all devices on its bus, and transitioning the Bus itself to only those power states that are consistent with those of its devices. This means that the Bus state can be no lower than the highest state of one of its devices. However, enabled wake-up events can affect this as well. For example if a particular device is in the D2 state and set to wake-up the system, and the bus can only forward wake-up requests while in the D1 state, then the Bus must remain in the D1 state even if all devices are in a lower state.

Device power state transitions are explicitly commanded by the driver and invoked through bus-specific mechanisms (e.g., ATA Standby command, USB Suspend, etc.). In some cases, bus-specific mechanisms are not available and device-specific mechanisms must be used. Note that the explicit command for entering the D3 state may be the removal of power.

The following definitions apply to devices of all classes:



- **D0:** Device is on and running. It is receiving full power from the system, and is delivering full functionality to the user.
- **D1:** Class-specific low-power state (defined below) in which device context may or may not be lost.
- **D2:** Class-specific low-power state (defined below) in which device context may or may not be lost. Attains greater power savings than D1.
- **D3:** Device is off and not running. Device context is lost. Power may be removed from the device.

## Input Device Power State Definitions

### D0

Input device is on and running:

- device is receiving full power from its power source,
- device is delivering full functionality to the user,
- device is preserving applicable context and state information.

### D1

Input device power consumption is greatly reduced:

- in general, device is in a power conservation state and is not delivering any functionality to the user except wake-up functionality if applicable,
- device status, state, or other information indicators (e.g., LED's, LCD displays, etc.) are turned off to save power,
- the following device context and state information should be preserved by device driver software:
  - Keyboard: Num, Caps, Scroll Lock states – and Compose and Kana states if applicable - and associated LED/indicator states, Repeat delay, Repeat rate,
  - Joystick: forced feedback effects (if applicable),
  - Any input device: all context and state information that cannot be preserved by the device when it's conserving power.

### D2

This state is not defined for input devices, use D1 as the power conservation state instead.

### D3 (Power may be removed)

Input device is off and not running:

- in general, device is off and is not delivering any functionality to the user except wake-up functionality if applicable,
- device context and state information is lost.

## Input Device Power Conservation Policy

The runtime power conservation policy for input devices is simple and straightforward:

- devices are by default always on (D0).
- devices transition to other power states only when requested by the system (or when power is removed).
- devices with wake-up capability enabled can request a power state transition by generating a wake-up event.

| Present State | Next State | Cause                  |
|---------------|------------|------------------------|
| D3            | D0         | • Requested by system. |

|        |           |   |
|--------|-----------|---|
| D0     | D1 or D3* | <ul style="list-style-type: none"> <li>Requested by system (e.g. system goes to sleep w/ wake-up enabled).</li> </ul>   |
| D0, D1 | D3        | <ul style="list-style-type: none"> <li>Requested by system (e.g. system goes to sleep w/ wake-up disabled).</li> <li>Power is removed.</li> </ul>   |
| D1, D3 | D0        | <ul style="list-style-type: none"> <li>Device with wake-up capability enabled request transition by generating a wake-up event; request is ultimately granted by system.</li> <li>Requested by system.</li> </ul> |

\* Depends on capability of device (if device features D1 or D3 wake-up capability or not); device will be put in state with lowest possible power consumption.

## Input Device Wake-up Events

It is recommended, but not required, that input devices implement and support bus-specific wake-up mechanisms if these are defined for their bus type. This is recommended because a user typically uses an input device of some kind to wake up the system when it is in a power conservation state, for example, when the system is sleeping.

The actual input data (particular button or key pressed, etc.) that's associated with a wake-up event should never be discarded by the device itself, but should always be passed along to device driver(s) for further interpretation. It is up to the device driver(s) to implement a policy for how this input data should be interpreted, and decide what should be passed along to higher-level software, etc.

It is recommended that the device button(s) or key(s) used for power management purposes are clearly labeled with text and/or icons. This is recommended for keyboards and other input devices on which all buttons or keys are typically labeled with text and/or icons to identify their usage.

Examples of wake-up events include (but are not limited to):

**Keyboards:**

- press special purpose power management button (e.g., POWER button) to generate wake-up event, OR
- press designated dual usage key (e.g., Spacebar key) to generate wake-up event.

**Mice and pointing devices:**

- press any button (e.g., left or right button) to generate wake-up event.

**Any other type of input device:**

- press special purpose power management button (e.g., POWER button) to generate wake-up event, OR
- press designated dual usage button or key to generate wake-up event.

Examples of more advanced wake-up events include keyboard wake-up signaling when any key is pressed, mouse wake-up signaling on detection of X/Y motion, joystick wake-up signaling on X/Y motion, etc. However, in order to avoid accidental or unintentional wake-up of the system, and to give the user some control over which input events will result in a system wake-up, it's suggested that more advanced types of wake-up events are implemented as features that can be turned on/off by the user via, for example, a control panel type of software application.

## Minimum Input Device Power Capabilities

| State | Compliance Requirement         |
|-------|--------------------------------|
| D0    | Mandatory.                     |
| D1    | Optional.                      |
| D2    | Not defined for input devices. |

|    |            |
|----|------------|
| D3 | Mandatory. |
|----|------------|

## Recommendations for Human Interface Devices

Input devices compliant with the Human Interface Devices (HID) firmware specification v1.0 should deploy usages defined in the supplemental HID Usage Table specification v1.0 for power management buttons, i.e. POWER and SLEEP buttons. The Generic Desktop Page (page 0x01) has been extended with the following usages compared to what's defined in the core HID 1.0 specification:

- **System Control** (Usage ID 0x80),
- System Power Down (Usage ID 0x81),
- System Sleep (Usage ID 0x82),
- System Wake Up (Usage ID 0x83).

These usages should be used in following manner with the power management buttons:

### POWER button:

- Should send usage "System Power Down" when the button is pressed to power down the system. The system power policy manager will look up the POWER button action in the current power policy (by default, shutdown) and take that action.
- Should send usage "System Wake Up" when the button is pressed again to power up the system.

### SLEEP button:

- Should send usage "System Sleep" when the button is pressed to put the system to sleep. The system power policy manager will look up the SLEEP button action in the current power policy (by default, sleep) and take that action.
- Should send usage "System Wake Up" when the button is pressed again to wake up the system.

The power management buttons should be reported in a **System Control** application level collection (a.k.a. "top level" collection) in order to be interpreted correctly by the host system software. Power management buttons appearing in other application level collections will be ignored.

**Note:** In previous revisions of this specification, the "Keyboard Power" usage (index 102dec/66hex) as defined in the Keyboard/Keypad Page (page 0x07) in the core HID 1.0 specification was recommended as the way to implement a POWER button on a keyboard. However, this recommendation should not be followed anymore and has been replaced with the recommendations above.

## Recommendations for i8042 keyboards

i8042-Based keyboards should deploy the following scan codes for power management buttons, i.e., POWER and SLEEP buttons:

### Power event

Set1: Make = E0, 5E Break = E0, DE  
Set2: Make = E0, 37 Break = E0, F0, 37

### Sleep event

Set1: Make = E0, 5F Break = E0, DF  
Set2: Make = E0, 3F Break = E0, F0, 3F

### Wake event

Set1: Make = E0, 63 Break = E0, E3  
Set2: Make = E0, 5E Break = E0, F0, 5E

The Power, Sleep, and Wake event scan codes are the i8042 equivalents to the System Power Down, System Sleep, and System Wake Up HID usages as defined above.

## Appendix C: USB 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.

**Note:** 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 index (dec) | Usage Index (hex) | Usage                                      | Ref:typical AT-101 position | PC-AT | Mac-intosh | UNIX | Boot       |
|-------------------|-------------------|--|-----------------------------|-------|------------|------|------------|
| 0                 | 00                | Reserved (no event indicated) <sup>9</sup> | N/A                         | √     | √          | √    | 84/101/104 |
| 1                 | 01                | Keyboard ErrorRollOver <sup>9</sup>        | N/A                         | √     | √          | √    | 84/101/104 |
| 2                 | 02                | Keyboard POSTFail <sup>9</sup>             | N/A                         | √     | √          | √    | 84/101/104 |
| 3                 | 03                | Keyboard ErrorUndefined <sup>9</sup>       | N/A                         | √     | √          | √    | 84/101/104 |
| 4                 | 04                | Keyboard a and A <sup>4</sup>              | 31                          | √     | √          | √    | 84/101/104 |
| 5                 | 05                | Keyboard b and B                           | 50                          | √     | √          | √    | 84/101/104 |
| 6                 | 06                | Keyboard c and C <sup>4</sup>              | 48                          | √     | √          | √    | 84/101/104 |
| 7                 | 07                | Keyboard d and D                           | 33                          | √     | √          | √    | 84/101/104 |
| 8                 | 08                | Keyboard e and E                           | 19                          | √     | √          | √    | 84/101/104 |
| 9                 | 09                | Keyboard f and F                           | 34                          | √     | √          | √    | 84/101/104 |
| 10                | 0A                | Keyboard g and G                           | 35                          | √     | √          | √    | 84/101/104 |
| 11                | 0B                | Keyboard h and H                           | 36                          | √     | √          | √    | 84/101/104 |
| 12                | 0C                | Keyboard i and I                           | 24                          | √     | √          | √    | 84/101/104 |
| 13                | 0D                | Keyboard j and J                           | 37                          | √     | √          | √    | 84/101/104 |
| 14                | 0E                | Keyboard k and K                           | 38                          | √     | √          | √    | 84/101/104 |
| 15                | 0F                | Keyboard l and L                           | 39                          | √     | √          | √    | 84/101/104 |
| 16                | 10                | Keyboard m and M <sup>4</sup>              | 52                          | √     | √          | √    | 84/101/104 |
| 17                | 11                | Keyboard n and N                           | 51                          | √     | √          | √    | 84/101/104 |
| 18                | 12                | Keyboard o and O <sup>4</sup>              | 25                          | √     | √          | √    | 84/101/104 |
| 19                | 13                | Keyboard p and P <sup>4</sup>              | 26                          | √     | √          | √    | 84/101/104 |
| 20                | 14                | Keyboard q and Q <sup>4</sup>              | 17                          | √     | √          | √    | 84/101/104 |
| 21                | 15                | Keyboard r and R                           | 20                          | √     | √          | √    | 84/101/104 |
| 22                | 16                | Keyboard s and S <sup>4</sup>              | 32                          | √     | √          | √    | 84/101/104 |
| 23                | 17                | Keyboard t and T                           | 21                          | √     | √          | √    | 84/101/104 |
| 24                | 18                | Keyboard u and U                           | 23                          | √     | √          | √    | 84/101/104 |
| 25                | 19                | Keyboard v and V                           | 49                          | √     | √          | √    | 84/101/104 |
| 26                | 1A                | Keyboard w and W <sup>4</sup>              | 18                          | √     | √          | √    | 84/101/104 |
| 27                | 1B                | Keyboard x and X <sup>4</sup>              | 47                          | √     | √          | √    | 84/101/104 |
| 28                | 1C                | Keyboard y and Y <sup>4</sup>              | 22                          | √     | √          | √    | 84/101/104 |
| 29                | 1D                | Keyboard z and Z <sup>4</sup>              | 46                          | √     | √          | √    | 84/101/104 |

| Usage index (dec) | Usage Index (hex) | Usage  | Ref:typical AT-101 position | PC-AT | Mac-intosh | UNIX | Boot       |
|-------------------|-------------------|--|-----------------------------|-------|------------|------|------------|
| 30                | 1E                | Keyboard 1 and ! <sup>4</sup>                | 2                           | √     | √          | √    | 84/101/104 |
| 31                | 1F                | Keyboard 2 and @ <sup>4</sup>                | 3                           | √     | √          | √    | 84/101/104 |
| 32                | 20                | Keyboard 3 and # <sup>4</sup>                | 4                           | √     | √          | √    | 84/101/104 |
| 33                | 21                | Keyboard 4 and \$ <sup>4</sup>               | 5                           | √     | √          | √    | 84/101/104 |
| 34                | 22                | Keyboard 5 and % <sup>4</sup>                | 6                           | √     | √          | √    | 84/101/104 |
| 35                | 23                | Keyboard 6 and ^ <sup>4</sup>                | 7                           | √     | √          | √    | 84/101/104 |
| 36                | 24                | Keyboard 7 and & <sup>4</sup>                | 8                           | √     | √          | √    | 84/101/104 |
| 37                | 25                | Keyboard 8 and * <sup>4</sup>                | 9                           | √     | √          | √    | 84/101/104 |
| 38                | 26                | Keyboard 9 and ( <sup>4</sup>                | 10                          | √     | √          | √    | 84/101/104 |
| 39                | 27                | Keyboard 0 and ) <sup>4</sup>                | 11                          | √     | √          | √    | 84/101/104 |
| 40                | 28                | Keyboard Return(ENTER) <sup>5</sup>          | 43                          | √     | √          | √    | 84/101/104 |
| 41                | 29                | Keyboard ESCAPE                              | 110                         | √     | √          | √    | 84/101/104 |
| 42                | 2A                | Keyboard DELETE (Backspace) <sup>13</sup>    | 15                          | √     | √          | √    | 84/101/104 |
| 43                | 2B                | Keyboard Tab                                 | 16                          | √     | √          | √    | 84/101/104 |
| 44                | 2C                | Keyboard Spacebar                            | 61                          | √     | √          | √    | 84/101/104 |
| 45                | 2D                | Keyboard - and (underscore) <sup>4</sup>     | 12                          | √     | √          | √    | 84/101/104 |
| 46                | 2E                | Keyboard = and+ <sup>4</sup>                 | 13                          | √     | √          | √    | 84/101/104 |
| 47                | 2F                | Keyboard [ and { <sup>4</sup>                | 27                          | √     | √          | √    | 84/101/104 |
| 48                | 30                | Keyboard ] and } <sup>4</sup>                | 28                          | √     | √          | √    | 84/101/104 |
| 49                | 31                | Keyboard \ and                               | 29                          | √     | √          | √    | 84/101/104 |
| 50                | 32                | Keyboard Non-US# and ~ <sup>2</sup>          | 42                          | √     | √          | √    | 84/101/104 |
| 51                | 33                | Keyboard <sup>4</sup>                        | 40                          | √     | √          | √    | 84/101/104 |
| 52                | 34                | Keyboard ' and " <sup>4</sup>                | 41                          | √     | √          | √    | 84/101/104 |
| 53                | 35                | Keyboard Grave Accent and Tilde <sup>4</sup> | 1                           | √     | √          | √    | 84/101/104 |
| 54                | 36                | Keyboard , and < <sup>4</sup>                | 53                          | √     | √          | √    | 84/101/104 |
| 55                | 37                | Keyboard . and > <sup>4</sup>                | 54                          | √     | √          | √    | 84/101/104 |
| 56                | 38                | Keyboard / and ? <sup>4</sup>                | 55                          | √     | √          | √    | 84/101/104 |
| 57                | 39                | Keyboard CapsLock <sup>11</sup>              | 30                          | √     | √          | √    | 84/101/104 |
| 58                | 3A                | Keyboard F1                                  | 112                         | √     | √          | √    | 84/101/104 |
| 59                | 3B                | Keyboard F2                                  | 113                         | √     | √          | √    | 84/101/104 |
| 60                | 3C                | Keyboard F3                                  | 114                         | √     | √          | √    | 84/101/104 |
| 61                | 3D                | Keyboard F4                                  | 115                         | √     | √          | √    | 84/101/104 |
| 62                | 3E                | Keyboard F5                                  | 116                         | √     | √          | √    | 84/101/104 |
| 63                | 3F                | Keyboard F6                                  | 117                         | √     | √          | √    | 84/101/104 |
| 64                | 40                | Keyboard F7                                  | 118                         | √     | √          | √    | 84/101/104 |
| 65                | 41                | Keyboard F8                                  | 119                         | √     | √          | √    | 84/101/104 |
| 66                | 42                | Keyboard F9                                  | 120                         | √     | √          | √    | 84/101/104 |
| 67                | 43                | Keyboard F10                                 | 121                         | √     | √          | √    | 84/101/104 |
| 68                | 44                | Keyboard F11                                 | 122                         | √     | √          | √    | 101/104    |
| 69                | 45                | Keyboard F12                                 | 123                         | √     | √          | √    | 101/104    |
| 70                | 46                | Keyboard PrintScreen <sup>1</sup>            | 124                         | √     | √          | √    | 101/104    |
| 71                | 47                | Keyboard ScrollLock <sup>11</sup>            | 125                         | √     | √          | √    | 84/101/104 |

| Usage<br>index<br>(dec) | Usage<br>Index<br>(hex) | Usage                                     | Ref:typical<br>AT-101<br>position | PC-<br>AT | Mac-<br>intosh | UNIX | Boot       |
|-------------------------|-------------------------|---|-----------------------------------|-----------|----------------|------|------------|
| 72                      | 48                      | Keyboard Pause <sup>1</sup>               | 126                               | √         | √              | √    | 101/104    |
| 73                      | 49                      | Keyboard Insert <sup>1</sup>              | 75                                | √         | √              | √    | 101/104    |
| 74                      | 4A                      | Keyboard Home <sup>1</sup>                | 80                                | √         | √              | √    | 101/104    |
| 75                      | 4B                      | Keyboard PageUp <sup>1</sup>              | 85                                | √         | √              | √    | 101/104    |
| 76                      | 4C                      | Keyboard Delete Forward <sup>1</sup>      | 76                                | √         | √              | √    | 101/104    |
| 77                      | 4D                      | Keyboard End <sup>1</sup>                 | 81                                | √         | √              | √    | 101/104    |
| 78                      | 4E                      | Keyboard PageDown <sup>1</sup>            | 86                                | √         | √              | √    | 101/104    |
| 79                      | 4F                      | Keyboard RightArrow <sup>1</sup>          | 89                                | √         | √              | √    | 101/104    |
| 80                      | 50                      | Keyboard LeftArrow <sup>1</sup>           | 79                                | √         | √              | √    | 101/104    |
| 81                      | 51                      | Keyboard DownArrow <sup>1</sup>           | 84                                | √         | √              | √    | 101/104    |
| 82                      | 52                      | Keyboard UpArrow <sup>1</sup>             | 83                                | √         | √              | √    | 101/104    |
| 83                      | 53                      | Keypad NumLock and<br>Clear <sup>11</sup> | 90                                | √         | √              | √    | 101/104    |
| 84                      | 54                      | Keypad / <sup>1</sup>                     | 95                                | √         | √              | √    | 101/104    |
| 85                      | 55                      | Keypad *                                  | 100                               | √         | √              | √    | 84/101/104 |
| 86                      | 56                      | Keypad -                                  | 105                               | √         | √              | √    | 84/101/104 |
| 87                      | 57                      | Keypad +                                  | 106                               | √         | √              | √    | 84/101/104 |
| 88                      | 58                      | Keypad ENTER <sup>5</sup>                 | 108                               | √         | √              | √    | 101/104    |
| 89                      | 59                      | Keypad 1 and End                          | 93                                | √         | √              | √    | 84/101/104 |
| 90                      | 5A                      | Keypad 2 and Down Arrow                   | 98                                | √         | √              | √    | 84/101/104 |
| 91                      | 5B                      | Keypad 3 and PageDn                       | 103                               | √         | √              | √    | 84/101/104 |
| 92                      | 5C                      | Keypad 4 and Left Arrow                   | 92                                | √         | √              | √    | 84/101/104 |
| 93                      | 5D                      | Keypad 5                                  | 97                                | √         | √              | √    | 84/101/104 |
| 94                      | 5E                      | Keypad 6 and RightArrow                   | 102                               | √         | √              | √    | 84/101/104 |
| 95                      | 5F                      | Keypad 7 and Home                         | 91                                | √         | √              | √    | 84/101/104 |
| 96                      | 60                      | Keypad 8 and Up Arrow                     | 96                                | √         | √              | √    | 84/101/104 |
| 97                      | 61                      | Keypad 9 and PageUp                       | 101                               | √         | √              | √    | 84/101/104 |
| 98                      | 62                      | Keypad 0 and Insert                       | 99                                | √         | √              | √    | 84/101/104 |
| 99                      | 63                      | Keypad . and Delete                       | 104                               | √         | √              | √    | 84/101/104 |
| 100                     | 64                      | Keyboard Non-US\ and   <sup>3;6</sup>     | 45                                | √         | √              | √    | 84/101/104 |
| 101                     | 65                      | Keyboard Application <sup>10</sup>        | 129                               | √         |                | √    | 104        |
| 102                     | 66                      | Keyboard Power <sup>9</sup>               |                                   |           | √              | √    |            |
| 103                     | 67                      | Keypad =                                  |                                   |           | √              |      |            |
| 104                     | 68                      | Keyboard F13                              |                                   |           | √              |      |            |
| 105                     | 69                      | Keyboard F14                              |                                   |           | √              |      |            |
| 106                     | 6A                      | Keyboard F15                              |                                   |           | √              |      |            |
| 107                     | 6B                      | Keyboard F16                              |                                   |           |                |      |            |
| 108                     | 6C                      | Keyboard F17                              |                                   |           |                |      |            |
| 109                     | 6D                      | Keyboard F18                              |                                   |           |                |      |            |
| 110                     | 6E                      | Keyboard F19                              |                                   |           |                |      |            |
| 111                     | 6F                      | Keyboard F20                              |                                   |           |                |      |            |
| 112                     | 70                      | Keyboard F21                              |                                   |           |                |      |            |
| 113                     | 71                      | Keyboard F22                              |                                   |           |                |      |            |
| 114                     | 72                      | Keyboard F23                              |                                   |           |                |      |            |
| 115                     | 73                      | Keyboard F24                              |                                   |           |                |      |            |
| 116                     | 74                      | Keyboard Execute                          |                                   |           |                | √    |            |

| Usage<br>index<br>(dec) | Usage<br>Index<br>(hex) | Usage   | Ref:typical        |           |                |      |      |
|-------------------------|-------------------------|---|--------------------|-----------|----------------|------|------|
|                         |                         |   | AT-101<br>position | PC-<br>AT | Mac-<br>intosh | UNIX | Boot |
| 117                     | 75                      | Keyboard Help                                 |                    |           |                | √    |      |
| 118                     | 76                      | Keyboard Menu                                 |                    |           |                | √    |      |
| 119                     | 77                      | Keyboard Select                               |                    |           |                | √    |      |
| 120                     | 78                      | Keyboard Stop                                 |                    |           |                | √    |      |
| 121                     | 79                      | Keyboard Again                                |                    |           |                | √    |      |
| 122                     | 7A                      | Keyboard Undo                                 |                    |           |                | √    |      |
| 123                     | 7B                      | Keyboard Cut                                  |                    |           |                | √    |      |
| 124                     | 7C                      | Keyboard Copy                                 |                    |           |                | √    |      |
| 125                     | 7D                      | Keyboard Paste                                |                    |           |                | √    |      |
| 126                     | 7E                      | Keyboard Find                                 |                    |           |                | √    |      |
| 127                     | 7F                      | Keyboard Mute                                 |                    |           |                | √    |      |
| 128                     | 80                      | Keyboard Volume Up                            |                    |           |                | √    |      |
| 129                     | 81                      | Keyboard Volume Down                          |                    |           |                | √    |      |
| 130                     | 82                      | Keyboard Locking Caps<br>Lock <sup>12</sup>   |                    |           |                | √    |      |
| 131                     | 83                      | Keyboard Locking Num<br>Lock <sup>12</sup>    |                    |           |                | √    |      |
| 132                     | 84                      | Keyboard Locking Scroll<br>Lock <sup>12</sup> |                    |           |                | √    |      |
| 133                     | 85                      | Keypad Comma                                  |                    |           |                |      |      |
| 134                     | 86                      | Keypad Equal Sign                             |                    |           |                |      |      |
| 135                     | 87                      | Keyboard Kanji1 <sup>15</sup>                 |                    |           |                |      |      |
| 136                     | 88                      | Keyboard Kanji2 <sup>16</sup>                 |                    |           |                |      |      |
| 137                     | 89                      | Keyboard Kanji3 <sup>17</sup>                 |                    |           |                |      |      |
| 138                     | 8A                      | Keyboard Kanji4 <sup>18</sup>                 |                    |           |                |      |      |
| 139                     | 8B                      | Keyboard Kanji5 <sup>19</sup>                 |                    |           |                |      |      |
| 140                     | 8C                      | Keyboard Kanji6 <sup>20</sup>                 |                    |           |                |      |      |
| 141                     | 8D                      | Keyboard Kanji7 <sup>21</sup>                 |                    |           |                |      |      |
| 142                     | 8E                      | Keyboard Kanji8 <sup>22</sup>                 |                    |           |                |      |      |
| 143                     | 8F                      | Keyboard Kanji9 <sup>22</sup>                 |                    |           |                |      |      |
| 144                     | 90                      | Keyboard LANG1 <sup>8</sup>                   |                    |           |                |      |      |
| 145                     | 91                      | Keyboard LANG2 <sup>8</sup>                   |                    |           |                |      |      |
| 146                     | 92                      | Keyboard LANG3 <sup>8</sup>                   |                    |           |                |      |      |
| 147                     | 93                      | Keyboard LANG4 <sup>8</sup>                   |                    |           |                |      |      |
| 148                     | 94                      | Keyboard LANG5 <sup>8</sup>                   |                    |           |                |      |      |
| 149                     | 95                      | Keyboard LANG6 <sup>8</sup>                   |                    |           |                |      |      |
| 150                     | 96                      | Keyboard LANG7 <sup>8</sup>                   |                    |           |                |      |      |
| 151                     | 97                      | Keyboard LANG8 <sup>8</sup>                   |                    |           |                |      |      |
| 152                     | 98                      | Keyboard LANG9 <sup>8</sup>                   |                    |           |                |      |      |
| 153                     | 99                      | Keyboard AlternateErase <sup>7</sup>          |                    |           |                |      |      |
| 154                     | 9A                      | Keyboard SysReq/Attenti <sup>1</sup>          |                    |           |                |      |      |
| 155                     | 9B                      | Keyboard Cancel                               |                    |           |                |      |      |
| 156                     | 9C                      | Keyboard Clear                                |                    |           |                |      |      |
| 157                     | 9D                      | Keyboard Prior                                |                    |           |                |      |      |
| 158                     | 9E                      | Keyboard Return                               |                    |           |                |      |      |
| 159                     | 9F                      | Keyboard Separator                            |                    |           |                |      |      |



| Usage<br>index<br>(dec) | Usage<br>Index<br>(hex) | Usage                               | Ref:typical<br>AT-101<br>position | PC-<br>AT | Mac-<br>intosh | UNIX | Boot       |
|-------------------------|-------------------------|-------------------------------------|-----------------------------------|-----------|----------------|------|------------|
| 160                     | A0                      | Keyboard Out                        |                                   |           |                |      |            |
| 161                     | A1                      | Keyboard Oper                       |                                   |           |                |      |            |
| 162                     | A2                      | Keyboard Clear/Again                |                                   |           |                |      |            |
| 163                     | A3                      | Keyboard CrSel/Props                |                                   |           |                |      |            |
| 164                     | A4                      | Keyboard ExSel                      |                                   |           |                |      |            |
| 165-<br>223             | A5-DF                   | Reserved                            |                                   |           |                |      |            |
| 224                     | E0                      | Keyboard LeftControl                | 58                                | √         | √              | √    | 84/101/104 |
| 225                     | E1                      | Keyboard LeftShift                  | 44                                | √         | √              | √    | 84/101/104 |
| 226                     | E2                      | Keyboard LeftAlt                    | 60                                | √         | √              | √    | 84/101/104 |
| 227                     | E3                      | Keyboard Left GUI <sup>10;23</sup>  | 127                               | √         | √              | √    | 104        |
| 228                     | E4                      | Keyboard RightControl               | 64                                | √         | √              | √    | 101/104    |
| 229                     | E5                      | Keyboard RightShift                 | 57                                | √         | √              | √    | 84/101/104 |
| 230                     | E6                      | Keyboard RightAlt                   | 62                                | √         | √              | √    | 101/104    |
| 231                     | E7                      | Keyboard Right GUI <sup>10;24</sup> | 128                               | √         | √              | √    | 104        |
| 232-<br>255             | E8-FF                   | Reserved                            |                                   |           |                |      |            |

## Footnotes

1. 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.
2. Typical language mappings: US: \} Belg: µ`£ FrCa: <}> Dan:}\* Dutch: <> Fren:\*µ Ger: #' Ital: ù\$ LatAm: }`] Nor:,\* Span:}Ç Swed: ,\* Swiss: \$£ UK: #-.
3. Typical language mappings: Belg:<|> FrCa:«°» Dan:<|> Dutch:]][[ Fren:<> Ger:<|> Ital:<> LatAm:<> Nor:<> Span:<> Swed:<|> Swiss:<|> UK:\} Brazil:\}.
4. Typically remapped for other languages in the host system.
5. Keyboard Enter and Keypad Enter generate different Usage codes.
6. Typically near the Left-Shift key in AT-102 implementations.
7. Example, Erase-Eaze™ key.
8. Reserved for language-specific functions, such as Front End Processors and Input Method Editors.
9. Reserved for typical keyboard status or keyboard errors. Sent as a member of the keyboard array. Not a physical key.
10. Microsoft Windows key for Microsoft Windows 95 and “Compose.”
11. Implemented as a non-locking key; sent as member of an array.
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. Backs up the cursor one position, deleting a character as it goes.
14. Deletes one character without changing position.
15. See next page
16. See next page
17. See next page
18. See next page
19. See next page
20. See next page
21. Toggle Double-Byte/Single-Byte mode.
22. Undefined, available for other Front End Language Processors.
23. Windowing environment key, examples are Microsoft Left Win key, Macintosh Left Apple key, Sun Left Meta key
24. Windowing environment key, examples are Microsoft Right Win key, Macintosh Right Apple key, Sun Right Meta key.

Footnotes 15–20

| Note | AT-104      | DOS/V-109 (suggested) | PC98 (suggested) |
|------|-------------|-----------------------|------------------|
| 15   | No function |                       |                  |
| 16   | No function |                       |                  |
| 17   | No function |                       |                  |
| 18   | No function |                       |                  |
| 19   | No function |                       |                  |
| 20   | No function | No function           |                  |