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Information technology — Keyboard interaction model — Machine-readable keyboard description

Technologies de l'information — Modèle d'interactions sur claviers — Description de clavier lisible à la machine

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Foreword

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ISO/IEC 24757 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 35, *User interfaces*.

Introduction

This International Standard is intended for those who design operating systems or software applications which take account of the keyboard being used (including the complete presentation of the keyboard on screen for documentation purposes). Its goal is to harmonize industry practices with regard to machine-readable keyboard descriptions (PCs, PDAs, Linux, Windows, Apple, etc.). Its ultimate aim is to facilitate the production of interoperable drivers for the user and to better assist the user by offering a more precise mapping between the physical keyboard layout and geometrical configuration, and the logical interface available to the operating system and its applications.

Information technology — Keyboard interaction model — Machine-readable keyboard description

1 Scope

This International Standard provides a formal description format that can not only fully describe the international keyboards standards, but also the capabilities of keyboards in the marketplace of today and the foreseeable future and their functioning with corresponding operating systems. It describes possible interactions between the keys of a keyboard and standardizes the keyboard description so that it is machine-readable while staying relatively easy to interpret by human beings.

2 Conformance

The machine-readable description of a keyboard is in conformity with this International Standard if it meets the requirements of 5.1 to 5.9.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 639-1, *Codes for the representation of names of languages — Part 1: Alpha-2 code*

ISO 639-2, *Codes for the representation of names of languages — Part 2: Alpha-3 code*

ISO/IEC 9995-1, *Information technology — Keyboard layouts for text and office systems — Part 1: General principles governing keyboard layouts*

ISO/IEC 9995-2, *Information technology — Keyboard layouts for text and office systems — Part 2: Alphanumeric section*

ISO/IEC 9995-3, *Information technology — Keyboard layouts for text and office systems — Part 3: Complementary layouts of the alphanumeric zone of the alphanumeric section*

ISO/IEC 10646, *Information technology — Universal Multiple-Octet Coded Character Set (UCS)*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 9995-1 and the following apply.

4.1
reference coordinates
identifier formed by one letter and two decimal digits, referring to the numbering grid according to which a key can be positioned at the intersection of a row and a column of the keyboard, where rows are identified by letters and columns by digits

5 Requirements

5.1 Description of keys and keyboard layouts

The keyboard is described for machines in this International Standard using the following properties:

- the logical coordinates of each key according to a grid numbering system established in ISO/IEC 9995-1. These coordinates are called “reference coordinates”;

  NOTE The reference coordinates of a keyboard may refer to a keyboard standard.

- the description of the size in millimeters (mm), shape and physical coordinates of each key of a hardware keyboard, to allow reproducing the user’s keyboard precisely on a computer screen; a binding is made with the reference coordinates;

- optionally, principal region or country and language codes applicable to this layout;

- actual labeling appearance;

- the logical division of each key of the keyboard into groups and levels within each group.

Within a group, at a given level, each character is described using five other properties:

- by a string of identifiers from ISO/IEC 10646, consisting of the letter "U" followed by 8 or 4 to 6 hexadecimal digits; if the character is a composed or combined character, identifiers of the individual characters making up the resulting character are given with the sequence that allows this composition;

- optionally, by its character name in a given natural language, identified according to ISO 639-1 code or ISO 639-2 terminology code;

- optionally, by one or many "scan codes" (which may vary depending on the keyboard state, on the hardware in use, etc.);

- in case a key position makes a key become a dead key, a description of user-required combinations, with resulting character or characters;

- optionally, a tag to identify characters whose glyph engraved on the key top is different from its internal representation (e.g., U00A6 broken vertical bar vs. U007C solid vertical bar).

NOTE The description of required combinations does not preclude the keyboard drivers to generate other characters if these combinations are already defined. The description mentioned here makes sure that what the end-user needs is taken care of, regardless of previous definitions.

This description includes the interaction of keys between them to produce results.

The following clause describes the different states of a keyboard necessary to the input of characters and taken into account in this International Standard.

5.2 States resulting from the interaction of function keys used for input

Hitting one of the following function keys determines a state of the keyboard that produces the desired character. This clause standardizes the conventional states produced by the interaction of these keys with alphanumeric keys.

- Level 2 Select (also called «Shift): per se, this key allows input of level 2 characters in the active group.

- Level 3 Select (also called « AltGr »): per se, this key allows input of level 3 characters in the active group.

- Control: this key is often used in practice with one of the preceding keys for entering characters. See below the interpretation that this International Standard prescribes for these interactions.

- Group Select: per se, this key allows changing group. This action may be locking or not.

  ISO/IEC 9995-2 specifies what follows to this effect :

  For the input of graphic character repertoire of collection 281 (titled MES-1) as specified in ISO/IEC 10646-1:2000/Amd.1, a Common Secondary Group Layout (to be used as group 2) is specified in ISO/IEC 9995-3. Specifically for group 2, the activation of group 2 with the Group select function is recommended to be latching for the next character entered and for this character only. In other words, activation of group 2 changes the logical state of the keyboard so that all keys involved in this activation can be released, and still, the next key typed will be selecting a character in group 2. After typing such a character in this mode, the keyboard then reverts back automatically to the group active before group 2 was activated.

  NOTE It is recommended, when a group which defines a complete script (e.g. Hiragana, Katakana, Cyrillic, Greek, Arabic, Hebrew) is selected, that the group be locked in this position until another group select or a de-selection is done (e.g., after Hiragana is selected, returning to Group 1 is typically done by explicitly deselecting Hiragana). The exact way to activate the group selection with a Group Select function is not standardized at this point. It is recommended that at the minimum any Group locking, except for group 1 and group 2, be visually indicated by an appropriate means (e.g. lamp, LCD or screen indication). Ideally the actual group in use should at any time be identified to the user.

- Usual combinations of certain function keys and their standardized interpretation:

  a) *Level 2 Select* + *Level 3 Select* (Shift+AltGr) shall be interpreted as follows (two scenarios are possible):

  1. According to ISO/IEC 9995-2 : « Specifically, for the harmonized 48 graphic key keyboard arrangement, when characters are allocated in more than one group, the *Group select* function shall be activated by holding a *Level 3 select* key *[AltGr]* depressed while depressing a *Level 2 select [Shift]* key or vice-versa. » One will understand that releasing these two keys without hitting a third key at the same time shall have the same effect as hitting a dedicated *Group Select* key.

  2. If an alphanumeric key is hit while the *Level 2 Select* and *Level 3 Select* are depressed, the state of the keyboard shall be interpreted as providing access to a group related to the previously active group, but different, at level 1. Certain implementations consider this as equivalent to a virtual level 4 in the active group. Although that does not correspond to a standardized concept, this view is tolerable in a restricted linguistic circle.

  b) *Level 2 Select [Shift]* + *Control* shall be interpreted as follows:

  If an alphanumeric key is hit while the *Level 2 Select [Shift]* and *Control* are depressed, the state of the keyboard shall be interpreted as providing access to a group related to the previously active group, but different, at level 2. Certain implementations consider this as equivalent to a virtual level 5 in the active group. Although that does not correspond to a standardized concept, this view is tolerable in a restricted linguistic circle.

c) *Level 3 Select [AltGr] + Control* shall be interpreted as follows:

If an alphanumeric key is hit while the *Level 3 Select* and *Control* are depressed, the state of the keyboard shall be interpreted as providing access to a group related to the previously active group, but different, at level 3. Certain implementations consider this as equivalent to a virtual level 6 in the active group. Although that does not correspond to a standardized concept, this view is tolerable in a restricted linguistic circle.

d) *Level 2 Select [Shift] + Group Select* shall be interpreted as follows:

If an alphanumeric key is hit while the *Level 2 Select* and *Group Select* are depressed, the state of the keyboard shall be interpreted as providing access to a group related to the previously active group, but different, at level 2. Certain implementations consider this as equivalent to a virtual level 5 in the active group. Although that does not correspond to a standardized concept, this view is tolerable in a restricted linguistic circle. As an example, in the context of ISO/IEC 9995-3, where group 1 is a Latin national group and where the related group is group 2 (« *Common Secondary Group Layout* » according to ISO/IEC 9995-3 nomenclature), the state of the keyboard locates the next character entry in Group 2, at level 2.

e) *Level 3 Select [AltGr] + Group Select* shall be interpreted as follows:

If an alphanumeric key is hit while the *Level 3 Select* and *Group Select* are depressed, the state of the keyboard shall be interpreted as providing access to a group related to the previously active group, but different, at level 3. Certain implementations consider this as equivalent to a virtual level 6 in the active group. Although that does not correspond to a standardized concept, this view is tolerable in a restricted linguistic circle. As an example, in the context of ISO/IEC 9995-3, where group 1 is a Latin national group and where the related group is group 2 (« *Common Secondary Group Layout* » according to ISO/IEC 9995-3 nomenclature), the state of the keyboard locates the next character entry in Group 2, at level 3.

5.3 Special keys

The following function keys exist on different commercialized keyboards. Their type can be generalized according to needs.

a) In Japan, texts can be edited in phonetic script (kanas) or in kanji (Chinese characters). In Korea a similar method is used to convert hangul (Korean letters) into hanza (Chinese characters). A kana-kanji (or hangul-hanza) conversion key allows converting a series of phonetic characters already entered into Chinese characters (kanji or hanza) on the fly. This key is not used to enter characters in conjunction with other keys but must be described as a special function key that involves a transformation program for already entered characters.

b) On certain keyboards outside of Japan or Korea, there exists a combine key that plays a role similar to the kana-kanji key but which is generalized for the generation of characters unavailable on the keyboard from characters already entered on it (fictional example: generating character § from the merging of the two characters s and s, or S and S, or from any combination of these two characters). The functioning of this combine key is not standardized at the moment. On certain keyboards, composition is transitive while on others it is more of a static nature. As for the kana-kanji or hangul-hanza conversion key, hitting the combine key involves a transformation program for already entered characters.

5.4 Dead keys

Certain keys are called «dead keys» because hitting them generates a partial character which may or may not appear on the screen. The complete character (also called «fully formed» or «precomposed») is generally made of a base letter and of one or many diacritical marks.

NOTE ISO/IEC 9995-3 says what follows about generating fully-formed characters with the help of dead keys:

«Diacritical marks appear above or below certain letters, and all of them are non-spacing characters. Actuating a key with a diacritical mark, followed by actuating a key with a letter, shall indicate that the graphical symbols of the two characters are intended to be combined. Actuating a key with a diacritical mark, followed by actuating the space bar, shall indicate that the diacritical mark is intended to appear as a graphic character of its own (i.e. free-standing).

It is recommended that the method used for the deletion of a character should also be used to cancel a partially-constructed character, such as a diacritical mark without a following letter or a following Space character.»

NOTE Diacritical marks may also appear everywhere around the body of a letter or even inside it.

To this can be added that dead key usage may also be transitive, like for the case of combine keys, i.e. certain scripts (polytonic Greek, Vietnamese) require the possibility to enter more than one diacritical mark on a single base letter. Unless the base letters are directly available on the keyboard, precomposed with a first diacritical mark integrated to the letter (as in the case of Scandinavian å, which can also be affected by other diacritical marks), it is then necessary that the function of entering diacritical marks be transitive, i.e. the entry of multiple diacritical marks in a row be applicable to the base character which comes after these marks.

5.5 Stickiness and stable (explicit) locking or temporary (implicit) latching

The state of a keyboard may be locked in a stable or temporary fashion, generally after activating a key or a key sequence.

5.5.1 Stable locking (explicit)

The following keys or functions activate a stable locking, which is deactivated in pressing another time on the same key or in calling the same function:

- Capitals lock
- Level 2 lock

- Group lock
- Numeric lock

5.5.2 Temporary latching (implicit)

ISO/IEC 9995-3 recommends, when one presses the *Group selection* key, that the state of the keyboard be locked for the entering of the next key only (see also 5.2 under *Group select*). In fact this behaviour depends on the nature of the group invoked, and could apply to groups other than group 2. Group 2 has dead keys whose accents are applicable to basic Latin characters normally found in the group that prevailed before invoking group 2. It is logical to go back to the preceding group for hitting this key. Other characters of group 2 are also infrequently used characters.

Another group which contains infrequent characters may have this temporary latching property. The group definition must then have provision for this implicit temporary latching property (otherwise the group shall be locked explicitly).

5.5.3 Stickiness (accessibility)

Stickiness is a temporary function latching property applicable to function keys normally used in conjunction with other keys. The first use is to allow handicapped people to hit keys one by one, without having to type two keys simultaneously (for example for entering the initial capital letter of a sentence, the fact to hit the *Level 2 select* key in this mode will lock the state of the keyboard in capitals just for entering the next key).

In «sticky» mode, successively hitting function keys and releasing them, one by one, is equivalent to virtually maintaining a pressure on all these keys at the same time as long as an alphanumeric key has not been hit. At this moment only, the virtual depression of these function keys is deactivated.

The stickiness mode is activated in depressing a *Level 2 select* key five times in a row. It is deactivated in depressing again a *Level 2 select* key five times in a row.

5.6 Supplementary keys (accessible or not by the computer software) ; Email, Fn function keys, «Windows» keys, Sleep, On/Off)

Even if these keys send a scan code already processed by the computer, they shall be described like other keys, since technically they do not constitute exceptions to what the keyboard description could contain.

Other keys (those not sending a scan code to the computer) may be described narratively as the software might have to be aware of their existence and geometric placement on the keyboard for helping the user.

5.7 Complex state change (mainly for accessibility purposes)

This clause standardizes the following state changes:

Successively hitting *Level 2 select* five times in a row:

Hitting *Level 2 select* during 10 seconds:

[*Alt*][*Level 2 select*][*Print Screen*]:

etc.

5.8 Keyboard feedback

A protocol for the operating systems is specified in Annex A to precisely enquire the hardware for the precise keyboard model used. The response from the keyboard hardware is with a file respecting the keyboard description format specified in clause 5.9. This functionality is optional in this International Standard, and it implements "plug-and-play" functionality for keyboards.

5.9 Machine-readable keyboard description language

The keyboard description format is meant to be capable of describing existing capabilities of today's keyboard hardware and its associated software, plus foreseeable extensions. It is therefore desirable to define the format in an extensible international standard format like ISO SGML, in the form known as *ISO RELAX NG*, with an easy conversion to industry standard XML. The format is described in Annex B (normative).

The keyboard definition format is primarily intended to be used by the operating system, and during its boot process (eg. in the BIOS), but can also be used for other purposes, such as reporting from the hardware of a keyboard to help the operating system configuring the keyboard driver, or to present the keyboard on the screen with a user-friendly picture.

A good test whether the format is capable of supporting existing software is to do a mapping to predominant keyboard description formats and techniques such as Microsoft keyboard definitions, X keyboard definitions, UNIX command line keyboard definitions and industry standard XML. A description of different industry standard formal keyboard description formats and their correspondence to the formal keyboard description format defined in this International Standard is included in Annex D (informative).

In addition some functionality found in some products are covered, such as keyboards with programmable keys and keyboards with multiple key assignments such as telephone keypads.

The keyboard definition format is described in 4 sections:

1. a keyboard identification and general features section, including make and model, serial number, country or region and language to which the keyboard applies, engraving language identification, and distinctive features, such as relief, or presence of lights on keys.

2. the hardware geometry layout, which indicates a largely known geometry layout, such as a 102-key PC keyboard. This section also gives physical information such as size of keys, and amount of pressure needed to activate keys.

3. the keyboard layout, which gives the actual assignment of characters to each key.

4. key combinations which gives combinations of keys, such as those of characters affected by dead keys.

Any of the information may be left out, and the operating system or the user may override the information according to preferences. The order of precedence in the information modification is first the user, then the system and then the description coming from the hardware.

In the informative Appendix E a number of existing keyboard definition formats is described, together with a mapping between these description formats and the format defined in this International Standard.

Annex A
(normative)

Protocol for the exchange of information between the hardware keyboard and the software

A protocol is defined here to make a conforming keyboard report its configuration to the operating system. The report shall be data in accordance to Annex B.

The command to ask the keyboard to report its configuration is issued by the operating system via the sequence:

Set caps Lock
set num lock
clear num lock
set num lock
clear caps lock
clear num lock

NOTE Refer to Annex C for a description of some different stages in history of keyboard hardware and associated software.

Annex B
(normative)

Formal description language

This Annex specifies semantic and syntax for the keyboard description format defined in this International Standard.

B.1 Introduction

The keyboard description is represented as XML document, conforming to the formal definition expressed using RELAX NG syntax (see 1.). The purpose of the keyboard description is to provide the operating system (OS) and user applications with non-ambiguous complete explanation of the physical keyboard features and recommended usage: keycodes, indicators, modifiers, produced characters etc. The description is expected to be provided from hardware (wherever possible) or from the keyboard driver (for legacy hardware).

B.2 Overview

The keyboard description generally consists of 4 sections:

dictionaries

meta-information

non-functional information

functional information

Each section is represented as 2nd level XML sub-tree. The sections are not self-contained – functional and non-functional information refers to the elements defined within the first section of dictionaries.

B.3 Sections

B.3.1 Dictionaries

There are 4 dictionaries defined in the document:

- keycodes
- modifiers
- key types
- key interpretation rules

B.3.1.1 Keycodes

The list of keycodes contains set of pairs (string identifier, numeric keycode) which describes all possible scancodes which can be sent by the keyboard (hardware/driver). Also, after all keycode definitions, the list may contain a set of aliases – alternative names for already defined keycodes.