TECHNICAL REPORT

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Fourth edition

Information technology — Future keyboards and other input devices and entry methods

Technologies de l'information — Claviers futurs, autres dispositifs d'entrée associés et méthodes d'entrée liées

PROOF/ÉPREUVE

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 35, *User interfaces*.

This fourth edition cancels and replaces the third edition (ISO/IEC TR 15440:2005), which has been technically revised.

 PROOF/ÉPREUVE

Introduction

This Technical Report, supported by the history of information technology keyboards during the last three decades, lists current and anticipated problem areas as seen by users and tries to pave the way to foreseen work items in JTC 1 for solving issues of the user interface with keyboards, other input devices and input methods.

Information technology — Future keyboards and other input devices and entry methods

1 Scope

This Technical Report (TR) covers the following:

— different input requirements catering for national and international practices and support of cultural and linguistic diversity;

— recognition of requirements regarding comfort of use (for any user, including children, elderly and disabled people) and improved user productivity related to inputting data;

— enhancements of keyboards and related input devices and methods required for new emerging phenomena such as Internet, multimedia, virtual reality;

— virtual input requirements;

— labelling issues (soft [LCD] and hard, permanent and temporary labels), function symbols and icons.

This Technical Report does not cover implications of biometric input (fingerprint-based, iris-pattern-based, face-shape-based, etc.) devices for access and security.

This Technical Report is aimed at both the users and manufacturers and intends to present the user requirements regarding keyboards and associated devices and methods, at the time of publication of this technical report.

2 Terms and definitions

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

3 Benefits and disadvantages of current keyboards and data entry devices on the market

— Most existing desktop and laptop keyboards on the market are following ISO/IEC 9995-1 and ISO/IEC 9995-2. This helps for education and training.

— The situation on portable computers is less clear, as confusion very often exists between function and alphanumeric keys; some dedicated keys like the portable Fn key are either not "seen" by software or are used in different fashions between different manufacturers' equipment. Different cursor and editing functions are interfering with character data entry. Because of the reduced size of the keyboard, row A in particular is really confusing, function keys varying locations from model to model and not being really well-thought out (for example, the Insert key is sometimes placed immediately next to the Delete key, which is extremely error-prone for the user); blind or visually impaired persons have specific problems, particularly with portable computers: the variation in the placement of the different keys due to the lack of strictly defined international standards for common functions. Because of this, no clues exist to help them finding the location of these functions. Even if the functions are not universal, a survey of the different functions should be made among the devices available on the market and reserving a relative location to each one in an international standard would be desirable.

— Most keyboards misinterpret some parts of ISO/IEC 9995. For example, the decimal separator is not used as a function but rather as an alphanumeric key [this creates problems in countries in which the decimal separator is multiple (this function should not depend from output representation)];

another case in point is the function terminology that is multiple and does not always respect ISO/IEC 9995-7.

— New, much more programmable keyboard interfaces are now becoming available, such as programmed keyboards displayed on a touch screen or displayed on some surface and recognized via a camera. Standards for layouting such keyboards, including code assignment to each key, are now available in ISO/IEC 24757, but actual use is limited. Guidance on using such mechanisms should be produced.

4 Comfort of use and productivity considerations

4.1 General comfort of use and productivity

— No major improvement in the comfort of use has been done since 1995 except some innovative, albeit sometimes very specific platform-oriented tools for multimedia and Internet usage working with very specific drivers.

— Standardisation of placement and functionality of common functions would appear to be possible as technology is stabilising.

EXAMPLE Print Screen function could be selectable at the platform-level as either an application-dependent function or as a "hard-wired" feature that prints the screen independently of the application running under a given operating system.

— Placement and functionality of functions such as Select Level 3 and Group Select remain to be fixed (American keyboards typically do not have a Level 3 select function, for example, and Group Select, when available, is done in different fashions due to lack of guidance in the first edition of ISO/IEC 9995).

— One important drawback of current keyboards is that no software can be made "aware" of the actual geometric layout as it is seen by the user, nor of the actual engraving seen by the user; if standard (de-facto or de-jure, even OEM) keyboards were registered and assigned a worldwide-fixed number, then the keyboard could identify itself (i.e. the actual engraving and geometry) to the software on request and then the software could better display actual mapping to other character sets than those engraved on the keyboard in addition to these. This is of particular importance in a more and more global, multilingual environment. Such a scheme would not necessitate a change in the actual "scan-code" technology used today. The use of ISO/IEC 24757 allows negotiating information on actual engraving of the keyboard.

— Comfort of use is highly dependent of the actual work done by a specific user; reassigning keys allows improvement of user productivity; this is possible only if the software is aware of the actual placement of keys of which it "sees" the "scan codes"; keyboards should ideally be designed according to human ergonomics and this is rarely the case. As an example, the common square keyboard is not ergonomically designed according to the function of normal hands/arms.

— Reassignment of actual "scan codes" of the physical keyboard by software would be desirable (so far, such reassignment is very difficult at the keyboard-driver level if at all possible) for example, to allow the use of a 7-8-9 layout on a 1-2-3 numeric keypad. Currently, hard-wired "scan codes" can be interpreted differently by software but that advantage becomes, at the same time, a problem if all "keyboard-scan-code-aware" programs do not all use the same interpretation of these "scan codes". Such a reassignment would greatly improve software compatibility while serving the end-user and innovative application needs.

— an NP is desirable to standardise the minimum set of keyboard software-driven functions that should be made available by an operating system (and optionally, by an application), standardising placement of the involved function keys at the same time. Functionality could include email, web access, and turning audio on and off.

— ISO/IEC/TR 30109 has been approved to facilitate, among other things, a better match between the user’s needs for functionality including national characters and input methods and the available keyboard hardware, e.g. at an Internet café or a hotel in a foreign country.

— Function of the “Capitals Lock”/”Shift Lock” key.

While ISO/IEC 9995-2 expresses that a key providing one of the functions Capitals lock (usually called “Caps Lock”), Level 2 lock (i.e. “Shift lock”), or Generalized lock (which is not specified further) needs to be present, the exact function of this key is not standardized in the ISO/IEC 9995 series. Common implementations show the inheritance from the mechanical typewriter, where such keys in fact were acting by mechanical engagement and mechanical release by pressing of either the lock key again or the Shift key. As, unlike on mechanical typewriters, the actuation of the lock key provides no special tactile or audible feedback for the touch typist (like the spring force or the special sound of the engaging mechanism), it is likely to be recognized only after long sequences of subsequent keys have been entered and misinterpreted.

A solution could be standardized which, in addition to avoid the effect of an inadvertent hitting of the lock key, has the advantage that the actuation has a unique function independent of any state (unlike a solution where the lock key switches between lock-on and lock-off, thus being dependent from the current lock state). This is the following:

— Shift + Lock (simultaneously pressed) switch to the state “Shift Lock”;

— “Level 3 Select” (i.e. AltGr) + Lock (simultaneously pressed) switch to the state “Caps Lock”;

— Lock pressed alone switches off any “Shift Lock” or “Caps Lock” state.

Thus, any inadvertent pressing of the lock key, while neither “Shift Lock” nor “Caps Lock” is on, has no effect.

The function of the “Num Lock” key can be standardized analogously.

4.2 Ergonomic keytop labelling for keyboards with a secondary group

The current ISO/IEC 9995-1 requires for layouts with more than one group that on the keytops, the characters of the (up to) three levels of each group are displayed in a column. While this is a clean solution from a systematic view, it has the ergonomic disadvantage that the height on every character, including the whitespace separating it from other characters or the keytop border, can be a third of the total keytop height at maximum. This applies even for layouts where only four characters are to be displayed, which is the case if the second group does not employ the third level, and employs the second level only for capital letters with the paired lowercase letters at the first level, thus the second level does not need to be displayed on the keytop also.

The T2 layout in the new German keyboard standard DIN 2137-01:2012-06 was designed deliberately to accommodate these requirements.

If there is a way to display in two rows and two columns, the characters could be displayed considerably larger. This is a real advantage especially for elderly people with age-related long-sightedness who are not touch-typists.

In consequence, when there are only two groups displayed and support for only one level of group 2 is required, a future standard should allow the labelling as follows, provided that all levels of group 1 use the same colour or the same shade of gray in column 2 and column 1, and that the level of group 2 displayed uses a different colour or shade of gray:

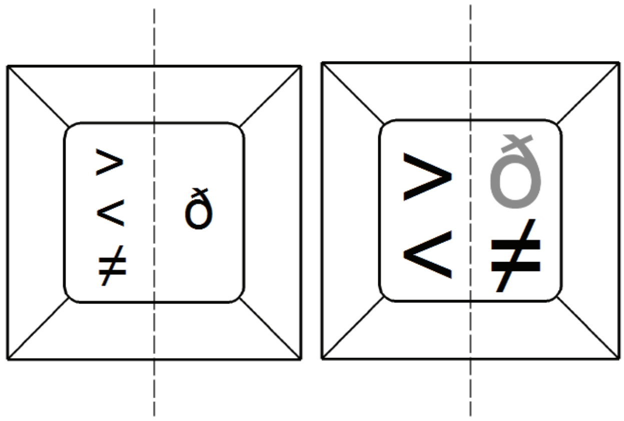
— Group 1, Level 1: lower left corner of the keytop (colour A or shade of gray A);

— Group 1, Level 2: upper left corner of the keytop (colour A or shade of gray A);

— Group 1, Level 3: lower right corner of the keytop (colour A or shade of gray A);

— Group 2, Level 1: upper right corner of the keytop (colour B or shade of gray B).

As the current ISO/IEC 9995-1 already allows an according labelling for keyboards which employ only a Group 1, this is a straightforward extension.



ISO/IEC 9995-1:2009 Possible future extension

Figure 1 — Comparison of possible allocation when support for only one level of group 2 is required

5 Keyboard classification [including linear keyboards, segmented keyboards, mono-handed keyboards, keyboards and input devices for disabled persons, specific keyboards for general (fixed and mobile telephones) and/or specific applications (banking, health care, trade, etc.), virtual keyboards]

Disabled and elderly persons can have many different problems with using a keyboard. These problems may be split up in, for example, problems with recognizing the wanted key, problems with controlling the movement of the arms and fingers, difficulties with the mouse movements without trembling, and possibility of using only one hand. This can result in different types of equipment to solve the problem.

Tactile identifiers are mentioned in ISO 9241-400 but not exactly specified. ETSI has produced a standard on specifying in detail the conventional “touch-type” marking on alphanumeric keys F and J and on the numerical keyboard part key 5. One problem with the numerical keyboard is that the tactile identifier on key 5 does not tell the difference between the “1-2-3” or “7-8-9” layout. It has been mentioned that the keyboard itself, instead of the keys, could be marked to tell which it is. Austria has proposed to instead have different marks.

6 Data entry methods for graphic character sets (including numerical or non-numerical use of numeric keypads, pen-based movements, alphabetic data entry using telephone keypads, alphabetic data entry using telephone keypads)

Some mobile telephones systems (e.g. GSM) give the possibility to send text with help of the telephone keypads (numeric keyboard). ISO/IEC 9995-8 assigns the letters A to Z to the digit keys. Additional characters are generally implemented and accessible through repeated pressing of the keys. The characters are then displayed on the window of the phone. A better and standardized way of doing it would be wanted to improve the usability of text input on small keyboards and to replace the variety of proprietary techniques in use in the industry.

Some of the improved industry technology includes just typing the key that represents multiple letters or characters once and then for a whole character sequence, e.g. limited by a space, to see what is the best probability for a properly spelled word in the respective language. Another idea is to use letter assignments tailored to a specific language fitted by typical letter usage in that language.

A specification method for Input Methods would improve portability of these methods among platforms for the benefit of users. A description of some Input Methods is contained in Annex A.

7 Logical interface with the central unit, methods of recognition of keys (including hardware or software recognized keys, use of scan codes, self-identifying keys, software-hidden keys, etc.)

Nowadays, most, if not all, keyboards on the market have integrated microprocessors which determine by themselves which keys of the keyboard are being typed and which send indications to a central computer (typically a PC) or a terminal controller whenever a key is depressed and when it is released, possibly with a repetitive indication at every given time interval if the key is kept depressed for a long enough time. Each one of such indications is called a “scan code” (from the fact that the microprocessor is scanning the keyboard all the time to see if an electrical contact is made on the intersection of a row and column of the keyboard matrix circuitry).

The only thing that is sent to the computer is hence a code which is used to theoretically identify the coordinates of the keys depressed (for PC, these coordinates correspond indeed to the original 1981 PC keyboard, a geometry that is no longer used) and this allows reprogramming the keyboard in the computer according to, for example, the language of the user or for any other customized purpose. This method of operation is, on one hand, very flexible from a programming point of view. But on the other hand, due to the numerous geometric reconfigurations of keyboards year after year and the necessity to be backward compatible, the software in the computer can no longer “know” for sure the actual location of a key depressed on the keyboard, which can be an annoyance if the keyboard is to be presented on the screen for help or actual operation purposes.

Furthermore, the software is not aware of what is engraved on the keys. At the end of the 1980s, LCD-display key keyboards were manufactured on a small scale which allowed the computer to show, in a programmable way, what were the characters supported by the keyboard driver in use. These keyboards were significantly expensive to produce (typically six times more than the average keyboard) and their production was stopped. This technology will possibly be replaced by less expensive ways of providing the same functionality but it will probably be more expensive than standard keyboards.

One idea to make sure that the computer would be made aware of what is engraved on the computer would be to assign, in addition to the scan code, an identification of the characters engraved on the keys (theoretically up to nine characters per key, for up to three groups of up to three levels each according to ISO/IEC 9995) which could be queried by the computer to the keyboard. This would allow the keyboard to be made aware of the complete physical layout of the actual keyboard (for display or help purposes), including customized one, without affecting the “traditional” mode of keyboard operation, and also inexpensively. The best way a character should be identified would be by using the canonical 4-octet encoding assigned to each character in the Universal character set (ISO/IEC 10646), which assigns a coding element to each one of the characters used by all known written languages on earth and much beyond. To complete the solution to the physical placement of the keys on the keyboard, each key should be identified in such a system by its location using the grid system of coordinates of ISO/IEC 9995. A standard for describing the physical layout of a keyboard with key assignment to ISO/IEC 10646 is now accomplished in ISO/IEC 24757.

An issue that would remain would be, for help purposes, to make known to the computer all the keys of the keyboard which depression is never indicated to the computer (keys such as Fn key on portable keyboards), and their location, by some private text identification and also in using the grid system of coordinates of ISO/IEC 9995. As the number of keys affected by those hidden keys may be everything from this hidden key itself to all the other keys of the computer (which depression is then not indicated to the computer), an easy way out of this would be that the keyboard make the computer aware of its generic model identification.