SLOVENSKI STANDARD
SIST-TP CR 14270:2003

01-oktober-2003

Evropske tipkovnice – Smernice in pregled (ISO/IEC 9995)

European keyboards - Guidelines and overview (ISO/IEC 9995)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: **CR 14270:2001**

SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-da25a5d909a8/sist-tp-cr-14270-2003

ICS:

35.180	Terminalska in druga periferna oprema IT	IT Terminal and other peripheral equipment

SIST-TP CR 14270:2003 **en**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

SIST-TP CR 14270:2003

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-da25a5d909a8/sist-tp-cr-14270-2003

SIST-TP CR 14270:2003

CEN REPORT

RAPPORT CEN

CEN BERICHT

CR 14270

July 2001

ICS

English version

European keyboards - Guidelines and overview (ISO/IEC 9995)

This CEN Report was approved by CEN on 16 June 2001. It has been drawn up by the Technical Committee CEN/TC 304.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-da25a5d909a8/sist-tp-cr-14270-2003

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

© 2001 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. CR 14270:2001 E

SIST-TP CR 14270:2003

Table of content

1 SCOPE 3
2 BACKGROUND 4
3 DEFINITIONS 4
4 ISO/IEC 9995 AND OTHER INTERNATIONAL STANDARDS ON KEYBOARDS 5
4.1 ISO/IEC 9995 Information technology – Keyboard layouts for text and office systems 6
4.1.1 Part 1: General principles governing keyboard layouts 6
4.1.2 Part 2: Alphanumeric section 8
4.1.3 Part 3: Complementary layouts of the alphanumeric zone of the alphanumeric section 11
4.1.4 Part 4: Numeric section 12
4.1.5 Part 5: Editing section 12
4.1.6 Part 6: Function section 13
4.1.7 Part 7: Symbols used to represent functions 13
4.1.8 Part 8: Allocation of letters to the keys of a numeric keypad 14
4.2 Other standards for keyboards 14
4.2.1 Ergonomic requirements on keyboards in ISO 9241 14
4.2.2 Keyboard input of coded characters ISO/IEC 14755 14
4.2.3 Segmented keyboards layouts ISO/IEC 15411 16
4.2.4 Portable computer keyboard layouts ISO/IEC 15412 16
5 EUROPEAN NATIONAL STANDARDS 16
5.1 Report on the Enquiry on keyboards 16
5.2 General considerations 16
5.3 The alphanumeric section of the layout 17
5.4 Considerations on the euro sign 18
6 CONSIDERATIONS ON FUTURE STANDARDIZATION 19
6.1 Standardization of European keyboards 19
6.2 International standardization 20
7 REFERENCES 22
7.1 Standards 22
7.2 Bibliography 22
ANNEX 1 24
CEN/TC304 N835 24
ANNEX 2 26
CEN/TC304 N855, updated March 1999 and 2000 26
ANNEX 3 39
The alphanumeric section of the layout of European keyboards 39
ANNEX 4 42
JTC1/SC 35 User Interfaces 42

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-ib25a5d909a8/sist-tp-cr-14270-2003

SIST-TP CR 14270:2003

1 SCOPE

This CEN report gives information on (the European national keyboards) keyboards used for European languages and shows how national bodies are using the international keyboard standards. It also considers common existing approaches on the future of keyboards and informs on the future international standardization..

The scope for the project according to CEN/TC 304 N872 “A meeting on the Keyboard PT in Nov 1998” is the following:

EUROPEAN KEYBOARDS. The deliverable is a CEN report giving guidance on the application of international keyboard standards in Europe. It will map how national bodies are using international keyboard standards, what national standards there are and give guidance to common approaches. The team shall, in contact with ISO, investigate the future of keyboards. Special attention shall be given to the Euro Sign on keyboards.

The report addresses this scope as follows:
How national bodies are using international keyboard standards and guidance to common approaches is given in clause 5 and Annex 3
National standards are listed in Annex 2
The future of keyboard standardization is discussed in section 6
The euro sign on keyboards is discussed in clause 5.4.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Clause 4 in this report gives information on international standards for keyboards. Of these ISO/IEC 9995 and ISO 9241-4 are most commonly used. (For exact references see clause 7)

SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-da25a5d909a8/sist-tp-cr-14270-2003

Clause 5 gives common information on the use of these standards and on the euro sign on keyboards.
Clause 6 gives some information on future standardization.
Annex 2 gives information from the National Bodies on keyboard standards used in their countries.
Annex 3 gives some more information on the layout of a number of keyboards for European languages.

The report is meant to give guidance to many parties:

- A country which decides to make its own keyboard standard may use it as background information on what other countries have standardized.
- A manufacturer who wants to produce keyboards for a country, may find information on the relevant national keyboard standard.
- A person who has to switch between keyboards from different European countries will find similarities and differences between them.
- A user who wants to specify keyboards for purchase.

The countries covered in this report are the CEN Member countries (Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom) and some interested CEN Affiliates (Estonia, Lithuania, Poland, Romania, Slovenia) and also Ukraine.

SIST-TP CR 14270:2003

2 BACKGROUND

Keyboards are the main way to enter text and data into computer systems in particular and for communication purposes, such as e-mail or for applications such as Internet shopping. A keyboard is linked to a computer and depends on both the keyboard hardware and the software drivers. Over time we have seen a quick development of the computer technology, but the layout of the keyboard still is more or less the same. (In the very start the typewriter was the main equipment with a keyboard, while today most keyboards are connected to a computer. Keyboards for typewriters were purely mechanical, but the modern keyboard consists of a combination of hardware and software. Even if the appearance of the keyboard and the way it works has developed since they were used mainly for typewriters, the layout of the keys are still almost the same.)

The layout determines the relative positions of the keys on the keyboard and the allocation to the keys of letters, numbers and other symbols, as well as of functions such as shift and “new line” (note here that ISO/IEC 9995-7 terminology is different for such terms). Most of the layout, and also the way in which each key in the alphabetic rows are a little offset from the key in front of it, is inherited from the mechanical constructions of typewriters.

There are international standards for keyboards and specifically for keyboard layouts but they do not fully standardize the way the characters and symbols are to be allocated to the keys on the keyboard. Only some recommendations are given, and if one accepts ISO/IEC 9995-3, it also standardizes two layouts for international use. Most European countries have national characters beyond the common Latin letters A to Z. This has resulted in keyboard layouts in the national standards or de facto standards differing between all countries.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-da25a5d909a8/sist-tp-cr-14270-2003

3 DEFINITIONS

The following terms are used in the main body of this report. The definitions are the official definitions taken from the standards ISO 9241, ISO/IEC 9995, ISO/IEC 14755 and ISO 15412.

capitals lock state: A state that, if activated, will result in the generation of the capital form of all graphic characters on the keyboard for which such a form exists. National standards or usage may determine which graphic characters are affected by this state.(ISO/IEC 9995-1)

beginning sequence: A specific sequence or combination of typing of keys, or an implementation-defined mechanism, the effect of which is to put the system in a mode that will allow entering a specific input sequence according to a method described in this International Standard. (ISO/IEC 14755)

control function: An action that affects the recording, processing, transmission or interpretation of data. (ISO/IEC 9995-1)

ending sequence: A specific sequence or combination of typing of keys, or an implementation-defined mechanism, the effect of which is to terminate the generating of a character whose selection was begun by the beginning sequence in conformance with a method described in this International Standard. (ISO/IEC 14755)

SIST-TP CR 14270:2003

graphic character: A character, other than a control function, that has a visual representation normally hand-written, printed or displayed. (ISO/IEC 9995-1)

graphic symbol: A visual representation of a graphic character, a control function or a combination of one or more graphic characters and/or control functions. (ISO/IEC 9995-1)

group: A logical state of a keyboard providing access to a collection of graphic characters or elements of graphic characters. Usually these graphic characters or elements of graphic characters logically belong together and may be arranged on several levels within a group. The input of certain graphic characters, such as accented letters, may require access to more than one group. (ISO/IEC 9995-1) (See note below)

group select: A function that, if activated, will change the keyboard state to produce characters from a different group. (ISO/IEC 9995-1)

home row: Row of the keyboard to which the fingers typically return between keystrokes. (ISO 9241-4)

keyboard slope: Angle between the plane of the key top surfaces and the horizontal surface. (ISO/IEC 15411)

level: A logical state of a keyboard providing access to a collection of graphic characters or elements of graphic characters. Usually these graphic characters or elements of graphic characters logically belong together, such as the capital forms of letters. In certain cases the level selected may also affect function keys. (ISO/IEC 9995-1) (See note below)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

level select: A function that, if activated, will change the keyboard state to produce characters from a different level. (ISO/IEC 9995-1)

SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-da25a5d909a8/sist-tp-cr-14270-2003

level lock state: A state that, if activated, will result in the generation of the characters assigned to a specific level. (ISO/IEC 9995-1)

portable computer: A lightweight compactly designed computer with a screen and attached keyboard that is capable of running on battery power for extended periods of time and is relatively easy to transport from one location to another by a single individual. (ISO/IEC 15412)

section: A block of keys, mostly with some functional relationship. (ISO/IEC 9995-1)

tactile indicator keys: Keys in the home row which contain a tactile aid for positioning the hands. (ISO 9241-4)

zone: A part of a keyboard section defined in ISO/IEC 9995. (ISO/IEC 9995-1)

Note -- As seen above the definitions of group and level are very similar. To clarify: a group is a collection of graphic characters and the characters in the group are subdivided into levels. Normally the small letters are found in the level 1 and the capital letters in level 2.

4 ISO/IEC 9995 AND OTHER INTERNATIONAL STANDARDS ON KEYBOARDS

SIST-TP CR 14270:2003

In the beginning many manufacturers designed their own keyboards. Different types of equipment, such as teletype machines, data-entry devices and typewriters for text, had different keyboard layouts. Moreover many nations published national standards for keyboards. When the use of keyboards grew more common and more types of equipment started to use keyboards, they were harmonized. International standards for keyboards were first developed for different types of equipment. Many of these layouts have now been harmonized into the ISO/IEC 9995 multipart standard. This work is carried out by ISO/IEC JTC 1/ SC 35 - User Interfaces in its Working Group 1 "Keyboards and input interfaces" (previously named ISO/IEC JTC 1/SC 18 WG9/SWGK). This SC is also currently working on the modernization of keyboards in order to cater for new requirements concerning ergonomy, productivity, cultural and linguistic adaptability and portability.

In addition, ISO/TC 159/SC 4 - Ergonomics of human system interaction - has standardized physical requirements for keyboards from an ergonomic point of view in ISO 9241-4.

In this section of the report descriptions of some of the international keyboard standards are given. They are only intended as an indication of the contents of the standards. For implementation purposes – e.g. as basis for national standardization -- the full text of the standards must absolutely be used.

4.1 ISO/IEC 9995 Information technology – Keyboard layouts for text and office systems

The purpose of ISO/IEC 9995 is to provide the standard for keyboard layouts for all the information technology products of today. It covers personal computers, workstations, computer terminals and related applications. It also includes normative specifications and recommendations for numeric keypads for products such as calculators and telephones. It allows some flexibility in the configuration of the keyboard layout but specifies the overall configuration in great detail.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/ffcd5f79-4f08-9b4a-a1ac-cdb/sist-tp-cr-14270-2003

The full name of ISO/IEC 9995 is ”Information technology – Keyboard layouts for text and office systems”. It is divided into the following eight parts.

Part 1: General principles governing keyboard layouts
Part 2: Alphanumeric section
Part 3: Complementary layouts of the alphanumeric zone of the alphanumeric section
Part 4: Numeric section
Part 5: Editing section
Part 6: Function section
Part 7: Symbols used to represent functions
Part 8: Allocation of letters to the keys of a numeric keypad.

As the names of the different parts show some parts are general and apply to all keyboards and some parts only apply to keyboards for a given specific functionality. A keyboard does not have to conform to all parts to conform to ISO/IEC 9995.

The following clauses give descriptions of the different parts. It is written only for educational purposes and shall not be used at the implementation of a keyboard without carefully reading the fully quoted standard.

4.1.1 Part 1: General principles governing keyboard layouts

SIST-TP CR 14270:2003

This part defines

- a physical division of the keyboard into sections and zones
- a key position numbering system
- a logical division of the keyboard into groups and levels
- methods of indicating allocations to keys.

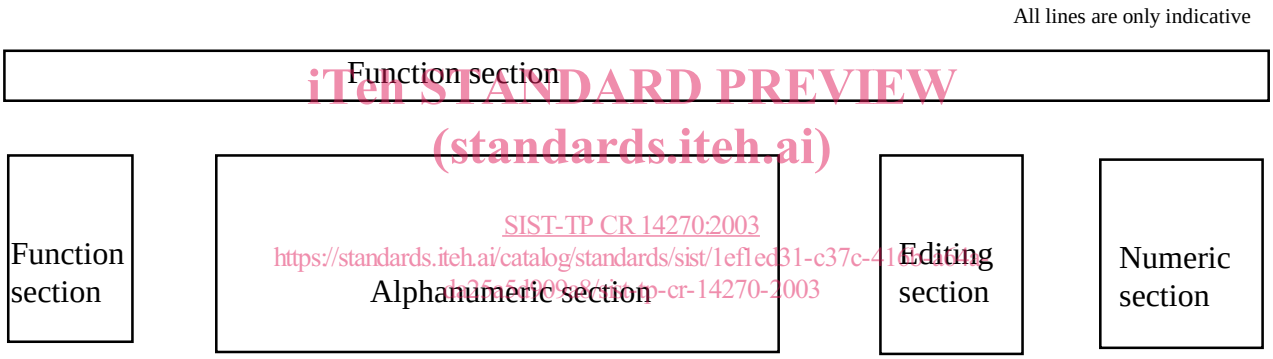
The physical division of the keyboard

The keyboard is divided into four sections:

- an alphanumeric section for letters, numbers and other symbols
- an editing section for cursor movements
- a function section for control functions and programmable functions
- a numeric section for a special numeric section.

Each of these sections is divided into zones.

A keyboard does not need to contain all sections and the relative sizes of the different sections are not standardized. Their relative positions are indicated in the following figure.

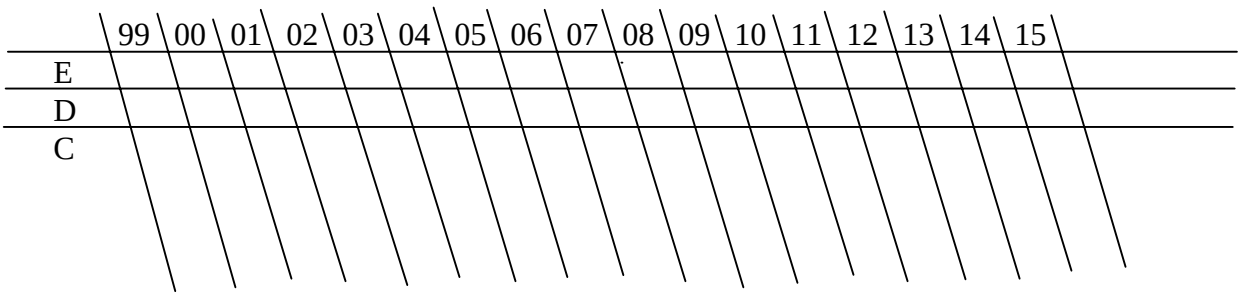


iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-41[illegible]-cr-14270-2003

Layout of sections

The key position numbering system

Each section is configured on a grid with intersections of rows and columns. Each row is identified by a capital letter of the Latin alphabet and each column is identified by a number. The following figure shows the configuration of the alphabetic section. The figure shows an angled grid, which is the one mostly used but it may also be a square grid. The other sections are configured on square grids.



SIST-TP CR 14270:2003

B																	
A																	
	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15

Alphanumeric section (angled grid)

Logical division of the keyboard into groups and levels.

The graphic characters are logically divided into groups and every group may contain up to three levels. Normally the default group is group 1 and the default level is level 1. Group 1 is by definition the group corresponding to a national keyboard and is the group which the user uses if no particular intervention is made. The national standards or de facto standards for keyboards normally define group 1 with levels 1 and 2 and sometimes also level 3. Part 3 of ISO/IEC 9995 defines group 2, which is by definition a supplementary group intended for international use and contains characters not commonly found on national keyboards using the Latin script. A keyboard may have any number of groups, but usually there is only group 1.

Methods of indicating allocations to keys.

Graphic characters or graphic symbols for control functions are normally engraved on the keys. They may also be shown to the user in other ways, e.g. as information in a product description. At least one character or symbol is shown on every key except on the space bar. Using groups and levels several characters or symbols can be allocated to one key. All these characters and symbols may be indicated on the key. Characters belonging to the same group are placed in the same column on the key. As an example, characters in the left-hand column are part of Group 1. The character/symbol belonging to level 1 is placed in the middle of the column with level 2 above and level 3 below. Level 3 may instead be shown on the key face. When both upper and lower case of the same letter are allocated to the same key, only the upper case needs to be shown.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-da25a5d909a8/sist-tp-cr-14270-2003

4.1.2 Part 2: Alphanumeric section

This part specifies

- the zones of the alphanumeric section
- the number and the location of some of the keys in the alphanumeric zone
- some control functions in the function zones

The zones of the alphanumeric section

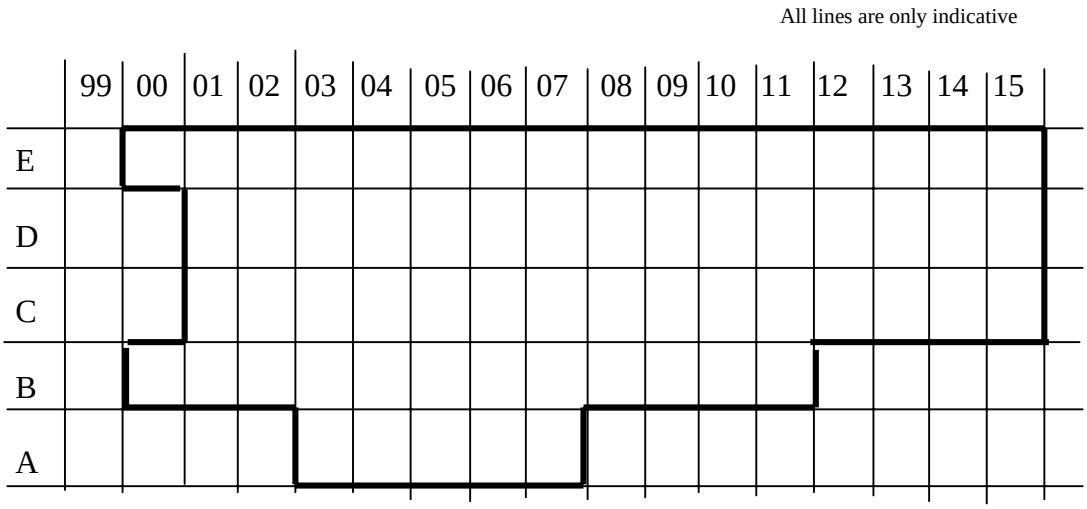
The alphanumeric section is divided into alphanumeric and function zones with the alphanumeric zone forming the core of the section. This is where you find the letters, numbers and symbols .

The number of the keys in the alphanumeric zone

The general keyboard arrangement is a very important and central feature that authorizes up to 58 graphic keys for linguistic and cultural requirements. It is intended to accommodate languages using specific letters and diacritics and consequently requiring more keys in order to provide a user-friendly access to those more often used.

SIST-TP CR 14270:2003

For historical reasons and harmonization purposes only does the alphanumeric zone permit, as a minimum, 45 graphic keys allocated as shown in the figure below, with the space bar in row A, extending at least as shown. The minimum of 45 keys are positioned within the thick lines, with at least 10 keys in row B, 11 keys in row C and 12 keys in row D and E.



General keyboard arrangement

A “harmonized” 48 graphic key keyboard arrangement is also defined, allowing some variations. On this keyboard the alphanumeric zone has 48 graphic keys and a space bar. Row B has 10 or 11 keys to the left of and including position 10. Row C and D have 12 keys in positions 01 to 12. Row E has 13 or 14 keys to the right of and including position 00.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

The allocation of graphic characters is not specified in this standard, neither for the general keyboard arrangement nor for the harmonized 48 graphic key keyboard arrangement. Instead, this is determined by a national standard or by national usage. If the characters of the Latin alphabet are allocated, at least the 83 invariant graphic characters of ISO 646 are accommodated. These are the 10 digits, the 2 times 26 small and capital letters a - z, 20 different marks and the space character. These graphic characters are normally allocated to levels 1 and 2 of group 1. The digits are allocated to row E with 1 - 9 normally on E01 to E09 with 0 allocated to the left or right. The space character is allocated to the space bar in row A. For the allocation of the rest of the characters there are only informative recommendations in an Annex A, which as an aid for developing new national standards refers to some commonly used layouts.

SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/2cdc21e2-27e4-416b-ae0b-da25a5d909a8/sist-tp-cr-14270-2003

Control functions in the function zones

The control function keys don't have a fixed position but are allocated in relation to the graphical keys defined by the general keyboard arrangement or the harmonized 48 graphic key keyboard arrangement versions.

Thus the keys for the control functions in the alphanumeric section are positioned to the right and the left of the alphanumeric zone. The following functions are allocated:

- *Level 2 select:* two keys, one on each end of the graphic keys in row B.
- *Tabulation:* one key on the left-hand side of the graphic keys in row D.
- *Capital lock, Level 2 lock* or *Generalized lock:* one key adjacent to the left-hand side of the graphic keys in row C.

SIST-TP CR 14270:2003

- *Return:* one key adjacent to the right-hand side of the graphic keys in row C. Part of this key may also take up space in row D.
- One key for *Backspace* or *Backward erase*.

In addition to these functions there may also be keys for *Control* and *Alternate*.

Also, following Amendment 1 to ISO/IEC 9995-2, for keyboards with characters allocated to level 3 at least one key shall be provided for the function *Level 3 select*. For those with characters allocated to more than one group, a *Group select* function shall be allocated to a key or a combination of keys.

These two functions are specified in a basic way for a harmonized 48 graphic key keyboard arrangement. They may also be implemented for a general keyboard arrangement without restriction:

- *Level 3 select:* may be allocated to row A or row B.
- *Group 2 select:* may be provided with the help of "level 2 select" and "level 3 select" keys actuated at the same time (according to the above-mentioned amendment, it shall be available at least in that way if the function is required). This function, when used for specific access to the group 2 as defined in ISO/IEC 9995-3, is recommended to be a temporary-only latching function -- this group 2 is such that it requires the use of a Latin group to immediately enter the letters to which group 2 non-spacing diacritics apply -- normally only the first actuated key thereafter will provide a character from group 2.

Note – On many keyboards on the market you may find the keys "Alt" and "Alt Gr". The "Alt" key is listed in part 7 of ISO/IEC 9995-7 with the function "Alternate" and the description "To select a function under application control (the corresponding key being used in conjunction with another key)". The "Alt Gr" key is not identified as such in ISO/IEC 9995 but is generally recognized as the key used to select level 3 (the ISO terminology uses the term "Level 3 Select" to be independent of any vendor terminology and to diminish the possibilities for confusion in terms between "Alt" and "Alt Gr").

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST-TP CR 14270:2003
https://standards.iteh.ai/catalog/standards/sist/1ef1ed31-c37c-416b-a64a-da25a5d909a8/sist-tp-cr-14270-2003

SIST-TP CR 14270:2003

4.1.3 Part 3: Complementary layouts of the alphanumeric zone of the alphanumeric section

This part specifies and allocates the characters for group two. It specifies the

- common secondary group layout
- operation of keys with diacritical marks
- complementary Latin group layout.

Unlike Part 2 which defines the keyboard from a geometric point of view, Part 3 really specifies the allocation of characters on the keyboard. It is important to note that normally group 1 is defined by national standards.

Common secondary group layout

Part 2 requires a keyboard with at least 48 graphic keys, allocating the Latin alphabet with at least the 83 graphical characters of ISO 646. The common secondary group layout includes the rest of the characters in ISO/IEC 6937 plus the euro sign. For these graphical characters and their allocation on the keyboard, see Part 3 of ISO/IEC 9995. No characters in group 2 need be shown (engraved) on the keytops. Some characters from the national standards may be duplicated; if so the duplicated characters are shown with their group 1and not group 2 positions. In Amendment 1 to this part of ISO/IEC 9995 the euro sign is allocated to position E04 level 2. Previously the “Dollar sign or Currency sign” was allocated to this position . That sign is now moved to level 3 of the same key. This is the only allocation in that level, and it is optional since ISO/IEC 9995-3 allows subsetting implementations. It is to be noted that the repertoire can be implemented using any kind of coding (for example the universal character set, ISO/IEC 10646).

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Diacritical marks

SIST-TP CR 14270:2003

Some of the graphical characters in ISO/IEC 6937 are diacritical marks. They may be used above or below certain letters and are used with many national characters. The diacritical mark key is actuated first, and then the key with the letter. The diacritical mark key is non-spacing. If instead a key with a letter which cannot take a diacritical mark, or the space bar, is actuated after the diacritical mark key, the mark appears as a graphic character of its own. As mentioned above, all non-spacing diacritical mark keys require entering a letter from a Latin script group, very often group 1, immediately after the depression of such a key in group 2. This is the reason why group 2 is recommended to be non-locking. It is however recommended that the latching is released after the entry of the following character.

Complementary Latin group layout

In this part also a complementary Latin group layout is specified, requiring a keyboard with at least 48 graphic keys. This layout is intended to be used as group n for keyboards without allocation for the Latin script when the Latin script is required, or as group 1 when there is no national keyboard layout available. Since it is a QWERTY layout, it is only one of the options (QWERTZ, AZERTY…) which are exemplified in annex A of Part 2 (which gives allocation guidelines and assistance in the development of new national standards). The complementary Latin group layout includes the letters a-z, the ten digits, most of the diacritical marks and some other marks and signs. These graphic characters allow the input of the full graphic character repertoire defined in ISO/IEC 6937. (For the exact specifications of these characters and their allocation on the keyboard please look in Part 3 of ISO/IEC 9995.) With that repertoire most European languages using the Latin script can be written (officially around 40 languages).