



SLOVENSKI STANDARD
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Ergonomics of human-system interaction - Part 410: Design criteria for physical input devices (ISO 9241-410:2008)

Ergonomie der Mensch-System-Interaktion - Teil 410: Gestaltungskriterien für physikalische Eingabegeräte (ISO 9241-410:2008)

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Ergonomie de l'interaction homme/systeme - Partie 410: Criteres de conception pour les dispositifs d'entrée physiques (ISO 9241-410:2008)

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English Version

Ergonomics of human-system interaction - Part 410: Design
criteria for physical input devices (ISO 9241-410:2008)

Ergonomie de l'interaction homme-système - Partie 410:
Critères de conception des dispositifs d'entrée physiques
(ISO 9241-410:2008)

Ergonomie der Mensch-System-Interaktion - Teil 410:
Gestaltungskriterien für physikalische Eingabegeräte (ISO
9241-410:2008)

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Foreword

This document (EN ISO 9241-410:2008) has been prepared by Technical Committee ISO/TC 159 "Ergonomics" in collaboration with Technical Committee CEN/TC 122 "Ergonomics", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2008, and conflicting national standards shall be withdrawn at the latest by August 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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**Ergonomics of human-system
interaction —**

**Part 410:
Design criteria for physical input devices**

Ergonomie de l'interaction homme-système —

Partie 410: Critères de conception des dispositifs d'entrée physiques
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 9241-410 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

This first edition of ISO 9241-410, together with ISO 9241-400, ISO 9241-411¹⁾, ISO 9241-420¹⁾ and ISO 9241-421¹⁾, partially replaces ISO 9241-4:1998 and ISO 9241-9:2000, technically revised as follows:

- terms and definitions from ISO 9241-4 and ISO 9241-9 have been transferred to ISO 9241-400;
- all guiding principles have been incorporated into ISO 9241-400 and unified so that they correspond to the scope of the new ISO 9241 series;
- these principles are applied in ISO 9241-410 in order to generate provisions for product design.
- an application procedure has been specified in ISO 9241-410, for reasons related to the structure of the “400” subseries of ISO 9241 and its *usability*- rather than property-based nature;
- for greater convenience, a separate normative annex covering each of the different devices, as well as an informative annex addressing issues related to accessibility, have been included in ISO 9241-410.

ISO 9241 consists of the following parts, under the general title *Ergonomic requirements for office work with visual display terminals (VDTs)*:

- *Part 1: General introduction*
- *Part 2: Guidance on task requirements*
- *Part 3: Visual display requirements*
- *Part 4: Keyboard requirements*
- *Part 5: Workstation layout and postural requirements*

1) Planned or under preparation. (See Annex A)

- Part 6: Guidance on the work environment
- Part 9: Requirements for non-keyboard input devices
- Part 11: Guidance on usability
- Part 12: Presentation of information
- Part 13: User guidance
- Part 14: Menu dialogues
- Part 15: Command dialogues
- Part 16: Direct manipulation dialogues
- Part 17: Form filling dialogues

The following part is under preparation:

- Part 129: Guidance on software individualization

ISO 9241 also consists of the following parts, under the general title *Ergonomics of human-system interaction*:

- Part 20: Accessibility guidelines for information/communication technology (ICT) equipment and services
- Part 110: Dialogue principles (standards.iteh.ai)
- Part 151: Guidance on World Wide Web user interfaces
- Part 171: Guidance on software accessibility SIST EN ISO 9241-410:2008
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- Part 300: Introduction to electronic visual display requirements
- Part 302: Terminology for electronic visual displays
- Part 303: Requirements for electronic visual displays
- Part 304: User performance test methods
- Part 305: Optical laboratory test methods for electronic visual displays
- Part 306: Field assessment methods for electronic visual displays
- Part 307: Analysis and compliance test methods for electronic visual displays
- Part 308: Surface-conduction electron-emitter displays (SED) [Technical Report]
- Part 400: Principles and requirements for physical input devices
- Part 410: Design criteria for physical input devices
- Part 920: Guidance on tactile and haptic interactions

Framework for tactile and haptic interaction is to form the subject of a future part 910.

Introduction

Input devices are a means for users to enter data into interactive systems. Generally speaking, an input device is a sensor that can detect changes in user behaviour (gestures, moving fingers, etc.) and transform it into signals to be interpreted by the interactive system. An *input device* is regarded as the combination of hardware with the software designed to use it (e.g. a driver).

This part of ISO 9241 defines design criteria for products on the basis of relevant properties of physical input devices as laid down in ISO 9241-400:2007. It is intended to cover assessment methods for laboratory use (in order to accelerate future development of test and evaluation methods) and user organizations in future parts of ISO 9241.

Most of the principles presented in this part of ISO 9241 have previously been defined or outlined in International Standards for keyboards and other input devices (ISO 9241-4 and ISO 9241-9). Where necessary, definitions of terms have been reformulated so that they are applicable for all input devices.

ISO 9241 was originally developed as a seventeen-part International Standard on the ergonomics requirements for office work with visual display terminals. As part of the standards review process, a major restructuring of ISO 9241 was agreed to broaden its scope, to incorporate other relevant standards and to make it more usable. The general title of the revised ISO 9241, "Ergonomics of human-system interaction", reflects these changes and aligns the standard with the overall title and scope of Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*. The revised multipart standard is structured as a series of standards numbered in the "hundreds": the 100 series deals with software interfaces, the 200 series with human centred design, the 300 series with visual displays, the 400 series with physical input devices and so on.

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See Annex A for an overview of the entire ISO 9241 series.

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Ergonomics of human-system interaction —

Part 410: Design criteria for physical input devices

1 Scope

This part of ISO 9241 specifies criteria based on ergonomics factors for the design of physical input devices for interactive systems including keyboards, mice, pucks, joysticks, trackballs, trackpads, tablets and overlays, touch-sensitive screens, styli and light pens, and voice- and gesture-controlled devices. It gives guidance on the design of these devices, taking into consideration the capabilities and limitations of users, and specifies generic design criteria for physical input devices, as well as specific criteria for each type of device. Requirements for the design of products are given either as a result of context-free considerations, or else can be determined based on the specified design criteria for the intended use; such specified criteria generally having been subdivided into task-oriented categories, wherever applicable.

EXAMPLE The resolution of a pointing device is given in relation to four levels of index of difficulty for the Fitts test. The required category for the resolution can be determined on the basis of the task characteristics, user population and context of use for the intended application.

This part of ISO 9241 does not specify the categories that are appropriate for devices as, according to the concept of usability, a product has no *inherent* usability. Selecting the category to which a certain property of a device belongs is subject to the design of a product.

This part of ISO 9241 is expected to be used by the manufacturers of physical input devices, including product designers and test organizations, in determining the design characteristics of a device for its intended context of use (user population, task, software or environment, etc.). The data generated by the users of this part of ISO 9241 for the description of the properties of their products can be applied in the selection of a device adequate for the actual context of use on the basis of the task primitives relevant for the task of the specific user population, and for achieving the required level of efficiency and effectiveness for a given system.

2 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 7000, *Graphical symbols for use on equipment — Index and synopsis*

ISO 9241-400:2007, *Ergonomics of human-system interaction — Part 400: Principles and requirements for physical input devices*

ISO/IEC 9995 (all parts), *Information technology — Keyboard layouts for text and office systems*

IEC 60417-DB, *Graphical symbols for use on equipment*²⁾

2) Permanently updated database.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9241-400 and the following apply:

3.1

bounce-free switch

switch that generates a single and definite signal after actuation

3.2

category

part of a system into which properties of entities can be arranged

3.3

class

category of a property of a product with rank order

NOTE 1 Class 1 is the *most*, and class *n* the *least*, favourable category of a specific property of a product, where *n* is the number of classes.

NOTE 2 An example of a property is *durability of the legends* of a key. If a key belongs to the highest class, it will fulfil all requirements for the lower categories.

3.4

compact keyboard

keyboard that features most properties of a full-size keyboard, with the editing section integrated into the alphanumeric section

NOTE A compact keyboard can have a numeric section.

3.5

force feedback

application of physical force in response to user input

EXAMPLE In games, or in car and plane simulators.

3.6

full-size keyboard

keyboard that comprises all sections and zones as described in ISO/IEC 9995-1

3.7

group

category of a property of a product without rank order

NOTE Some properties such as the size of a key do not constitute a virtue without further considerations. For such properties, the categorization may help to differentiate objects without being able to determine a rank in consideration of the specific property.

EXAMPLE A particular size of key on a keyboard that is suited for continuous touch-typing, a smaller key size for hand-held devices or a larger size for use with gloves.

3.8

haptic, adj

of or relating to, or proceeding from, the sense of touch

3.9

haptic display

display presenting information accessible through the sense of touch, mainly by, but not limited to, use of hands and fingers

3.10**haptic interface**

user interface based on touch, using the movements of the user as input and the sense of touch as output for tactile and kinaesthetic feedback

EXAMPLE Force feedback joysticks, Braille screen readers.

3.11**housing**

protective cover designed to contain or support a mechanical component

NOTE An input device is either integrated into its own housing or into another unit that comprises other functional units (e.g. control desk, control panel, telephone).

3.12**index of difficulty**

I_D

measure of the user precision required in a task

NOTE The index of difficulty, I_D , is measured in bits, and is calculated for selection, pointing, or dragging tasks by

$$I_D = \log_2 \frac{d + w}{w}$$

and for tracing tasks by

$$I_D = \frac{d}{w}$$

where

d is the distance of movement to the target;

w is the target width of the displayed target along the approach axis for selection, pointing or dragging tasks, and perpendicular for tracing tasks.

3.13**key arrangement**

spatial organization of keys of a keyboard following certain design rules or conventions

EXAMPLE Typewriter, calculator or telephone layout of keys for generating codes for numerals (numeric keys for digits 0 to 9) on office machines.

3.14**keypad**

functional unit that comprises at least a group of keys dedicated and arranged for a given functionality and possibly additional keys supporting related functionality

EXAMPLE Numeric keys, "Enter" key of keypad.

3.15**multi-tap**

alphanumeric input requiring several presses per character

3.16**section**

(keyboard) functional groups within computer keyboards for which different rules for layouts can apply

NOTE Some sections of existing keyboards are arranged according to more-than-century-old conventions.