INTERNATIONAL STANDARD

ISO 9241-420

First edition
2011-07-15

Ergonomics of human-system interaction —

Part 420: Selection of physical input devices

Ergonomie de l'interaction homme-système —

Partie 420: Sélection des dispositifs d'entrée physiques

Reference number
ISO 9241-420:2011(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Tables Annex H

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 9241-420 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

This first edition of ISO 9241-420, together with ISO 9241-400, ISO 9241-410 and ISO/TS 9241-411, partially replaces ISO 9241-4 and ISO 9241-9, technically revised as follows:

— terms and definitions from ISO 9241-4 and ISO 9241-9 have been transferred to ISO 9241-400;

— guiding principles, collected in ISO 9241-400, have been incorporated and unified so that they correspond to the scope of the new ISO 9241 series;

— test methods taken from ISO 9241-4 and ISO 9241-9 have been reviewed and amended and new test methods introduced and collected in annexes for greater convenience.

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 4: Keyboard requirements*

— *Part 5: Workstation layout and postural requirements*

— *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*

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 100: Introduction to standards related to software ergonomics* [Technical Report]

— *Part 110: Dialogue principles*

— *Part 129: Guidance on software individualization*

— *Part 143: Forms*

— *Part 151: Guidance on World Wide Web user interfaces*

— *Part 171: Guidance on software accessibility*

— *Part 210: Human-centred design for interactive systems*

— *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 for electronic visual displays*

— *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 309: Organic light-emitting diode (OLED) displays* [Technical Report]

— *Part 310: Visibility, aesthetics and ergonomics of pixel defects* [Technical Report]

— *Part 400: Principles and requirements for physical input devices*

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

— *Part 411: Evaluation methods for the design of physical input devices* [Technical Specification]

— *Part 420: Selection of physical input devices*

— *Part 910: Framework for tactile and haptic interaction*

— *Part 920: Guidance on tactile and haptic interactions*

The following parts are under preparation:

— *Part 143: Form-based dialogues*

— *Part 154: Interactive voice response (IVR) applications*

Human-centred design and evaluation methods, optical characteristics of autostereoscopic displays, and requirements, analysis and compliance test methods for the reduction of photosensitive seizures are to form the subjects of future parts 230, 330 and 391.

Introduction

Input devices provide the 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 them into signals to be interpreted by the interactive system.

This part of ISO 9241 gives guidance for selecting products on the basis of the relevant properties of the input devices, as outlined in ISO 9241-400, and the design criteria for products, as given in ISO 9241-410. It also includes test and evaluation methods for use at the workplace level. To accelerate the future development of test and evaluation methods, these are treated in separate annexes according to the maturity of the test procedure.

This part of ISO 9241 includes test and evaluation methods for application by user organizations. These methods can also be applied by test houses.

Ergonomics of human-system interaction —

Part 420:
Selection of physical input devices

1 Scope

This part of ISO 9241 provides guidance for the selection of input devices for interactive systems, based on ergonomic factors, considering the limitations and capabilities of users and the specific tasks and context of use. It describes methods for selecting a device or a combination of devices for the task at hand. It can also be used for evaluating the acceptability of trade-offs under the existing conditions.

The target users of this part of ISO 9241 are user organizations and systems integrators who tailor systems for a given context of use.

It is applicable to the following input devices: keyboards, mice, pucks, joysticks, trackballs, trackpads, tablets and overlays, touch-sensitive screens, styli and light pens. It does not specify design requirements or give recommendations for those devices.

NOTE 1 The selection guidance has been developed for the single-finger use of touchpads. Touchpads that allow the use of more fingers do exist; however, this part of ISO 9241 does not offer any guidance on their selection.

NOTE 2 The only physical component of a speech-recognition system is a microphone. Without proper knowledge of the context of use it is not possible to give guidance for selection.

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 9241-11, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 11: Guidance on usability*

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

ISO 9241-410, *Ergonomics of human-system interaction — Part 410: Design criteria for physical input devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9241-400 and ISO 9241-410 and the following apply.

3.1
appropriateness
application of the concept of usability on entities that are combined for a specific purpose

EXAMPLE 1 Achieving a certain level of usability for users with special needs or for uses where no single device can achieve the level of usability required for a certain task.

EXAMPLE 2 Achieving a certain level of usability for text input and dragging by a combination of a keyboard and a tablet.

NOTE See also ISO 9241-400 and ISO 9241-410.

3.2
cursor
visual indication of where the user interaction via keyboard (or equivalent input device) will occur

[ISO 9241-400:2007, 5.3.2]

3.3
dragging
dragging and dropping
moving one (or more) objects on a display by translating it along a path determined by a pointer

[ISO 9241-400:2007, 3.9.1]

3.4
accessibility
〈interactive system〉 usability of a product, service, environment or facility by people with the widest range of capabilities

NOTE 1 The concept of accessibility addresses the full range of user capabilities and is not limited to users who are formally recognized as having a disability.

NOTE 2 The usability-orientated concept of accessibility aims to achieve levels of effectiveness, efficiency and satisfaction that are as high as possible considering the specified context of use, while paying particular attention to the full range of capabilities within the user population.

[ISO 9241-20:2008, 3.1]

3.5
effectiveness
accuracy and completeness with which users achieve specified goals

[ISO 9241-11:1998, 3.2]

3.6
efficiency
resources expended in relation to the accuracy and completeness with which users achieve goals

[ISO 9241-11:1998, 3.3]

3.7
home row
row of the keyboard to which the fingers typically return between keystrokes

See Figure 1.

NOTE On the typical keyboard, the home row is row C as defined by ISO/IEC 9995-1:1994 in the alphanumeric section as well as in the numeric section.

[ISO 9241-400:2007, 3.6.1]

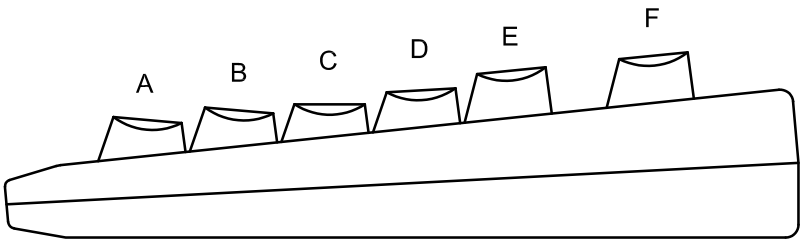

Figure 1 — Typical keyboard — Home row

3.8
home row height
h
height from the centre of the strike surface of an unactuated key in the home row to the support surface

See Figure 2.

[ISO 9241-400:2007, 3.6.2]

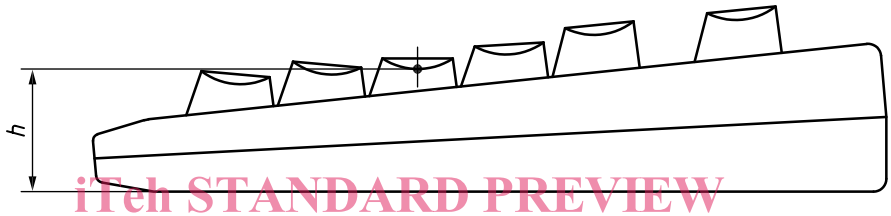

Figure 2 — Typical keyboard — Home row height

3.9
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

$$I_D = \log_2 \frac{d + w}{w} \quad (1)$$

and for tracing tasks by

$$I_D = \frac{d}{w} \quad (2)$$

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.

[ISO 9241-410:2008, 3.12]

3.10
input device
user-controlled device that transmits information to a system

[ISO 9241-400:2007, 3.6.3]

3.11
intended user population
group of human beings for which a product or a workstation is designed

EXAMPLE Male and female workers of Southeast Asian origin aged between 45 and 65 years.

[ISO 9241-400:2007, 3.7.7]

3.12
joystick
lever mounted in a fixed base used to control the movement of objects displayed on a screen

NOTE See Figure 3.

[ISO 9241-400:2007, 3.6.4]

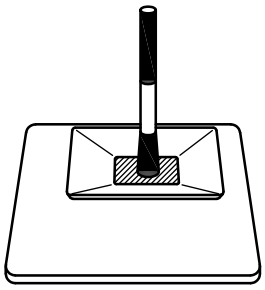

Figure 3 — Side view of example joystick

3.12.1
displacement joystick
joystick with a lever that tilts in the direction of applied force from a home position moving the display pointer in proportion to the displacement distance

[ISO 9241-400:2007, 3.6.4.1]

3.12.2
isometric joystick
joystick where the input depends on the force exerted rather than the position of the control

[ISO 9241-400:2007, 3.6.4.2]

3.13
keyboard layout
spatial allocation of keys on a keyboard

[ISO 9241-400:2007, 3.6.9]

3.14
keyboard profile
geometric (i.e. flat, stepped, sloped, dished or sculptured) configuration of the top of the keys

[ISO 9241-400:2007, 3.6.5]

3.14.1
dished profile keyboard
keyboard in which the side profile of the keys resembles a continuous concave curve

NOTE See Figure 4.

[ISO 9241-400:2007, 3.6.5.1]

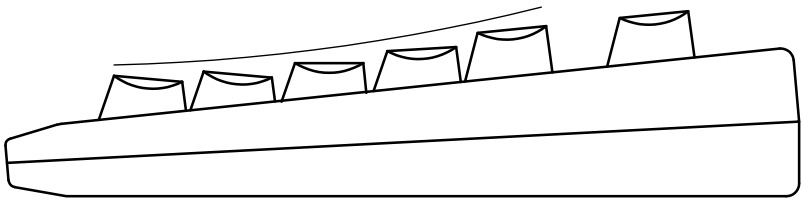

Figure 4 — Example of dished profile keyboard

3.14.2
flat profile keyboard
keyboard that has a zero slope with the front at the same height as the back when placed on a flat work surface

NOTE See Figure 5.

[ISO 9241-400:2007, 3.6.5.2]

Figure 5 — Example of flat profile keyboard

3.14.3
keyboard slope
α
angle between the plane of the key top surfaces (P-P) and the horizontal surface (H-H) as measured across row A-E using the notation of ISO 9995-1

See Figure 6.

NOTE For keyboards without an E row, rows B to D are used.

[ISO 9241-400:2007, 3.6.5.3]

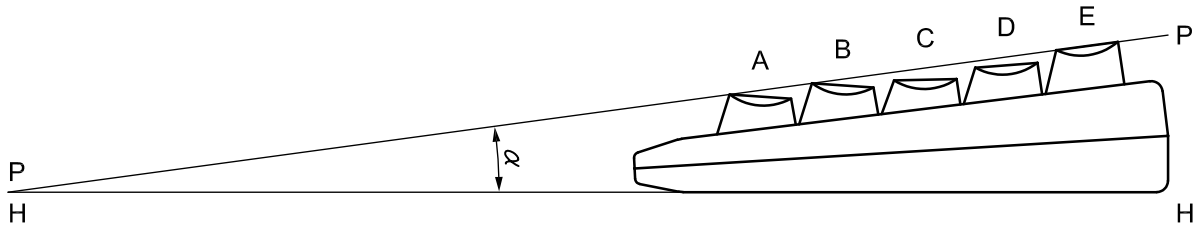

Figure 6 — Keyboard slope

3.14.4
sculptured profile keyboard
keyboard in which the side view of the keytops is shaped in other than a straight line

NOTE See Figure 7.

[ISO 9241-400:2007, 3.6.5.4]

Figure 7 — Example of sculptured profile keyboard