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**Ergonomic requirements for office work  
with visual display terminals (VDTs) —**

**Part 9:  
Requirements for non-keyboard input  
devices**

**iTeh STANDARD PREVIEW**

*Exigences ergonomiques pour travail de bureau avec terminaux à écrans  
de visualisation (TEV)*

*Partie 9: Exigences relatives aux dispositifs d'entrée autres que les claviers*

ISO 9241-9:2000

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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 3.

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 part of ISO 9241 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 9241-9 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

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
- Part 6: Guidance on the work environment
- Part 7: Requirements for display with reflections
- Part 8: Requirements for displayed colours
- Part 9: Requirements for non-keyboard input devices
- Part 10: Dialogue principles
- Part 11: Guidance on usability
- Part 12: Presentation of information
- Part 13: User guidance
- Part 14: Menu dialogues
- Part 15: Command dialogues

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- *Part 16: Direct manipulation dialogues*
- *Part 17: Form filling dialogues*

Annexes A, B, C and D of this part of ISO 9241 are for information only.

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## Introduction

Non-keyboard input devices are commonly used by operators to perform tasks with interactive office computer systems. Input device design can have a significant impact on efficiency, effectiveness and satisfaction. The requirements and recommendations are based on ergonomic principles.

The design requirements and recommendations are intended to address the fifth to ninety-fifth percentile of the population. However, when possible, non-keyboard input devices should be designed to accommodate the anthropometric characteristics of the intended user population.

Annexes A to D are included to provide information on potential methods of testing input devices and to encourage institutions or individuals to conduct research on these methods such that further validation can be supplied.

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# Ergonomic requirements for office work with visual display terminals (VDTs) —

## Part 9: Requirements for non-keyboard input devices

### 1 Scope

This part of ISO 9241 provides requirements and recommendations for the design of non-keyboard input devices. It only includes devices for which there exists sufficient published ergonomic information.

This part of ISO 9241 applies to several types of non-keyboard input devices designed for stationary use. It provides guidance based on ergonomic factors for the following input devices: mice, pucks, joysticks, trackballs, tablets and overlays, touch-sensitive screens, styli, and light pens. It gives guidance on the design of these devices used for typical office tasks so that the limitations and capabilities of users are considered. This part of ISO 9241 specifies methods for determining conformance through observation, performance, and by measuring the physical attributes of the various devices.

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### 2 Normative references

ISO 9241-9:2000

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The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 9241. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 9241 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 9241-3, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 3: Visual display requirements.*

ISO 9241-3:1992, Amendment 1:—<sup>1)</sup>, Annex C (normative): *Visual performance and comfort test.*

ISO 9241-5, *Ergonomic requirements for office work with visual display terminals (VDTs)— Part 5: Workstation layout and postural requirements.*

ISO 9241-7, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 7: Requirements for display with reflections.*

ISO 9241-8, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 8: Requirements for displayed colours.*

ISO 13406-2, *Ergonomic requirements for work with visual displays based on flat panels — Part 2: Requirements for flat panel displays.*

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1) To be published.

### 3 Terms and definitions

For the purposes of this part of ISO 9241, the following terms and definitions apply. The illustrations of the devices used in this clause do not necessarily represent the design requirements and recommendations of this part of ISO 9241.

#### 3.1 Actions

##### 3.1.1

##### **click**

depression and release of a button or actuation point on an input device

##### 3.1.2

##### **drag**

moving one or more objects on a display by translating it along a path determined by a pointer

##### 3.1.3

##### **free-hand input**

input where the input device controls the movement of the cursor without any constraints following the manual input of the user

##### 3.1.4

##### **pointing**

operation with a graphic user interface in which an input device is used to move a small display image (such as a pointer) to a specific location on the display

##### 3.1.4.1

##### **direct pointing**

hitting a target unaided by system feedback

##### EXAMPLE

By direct pointing with a finger or stylus.

##### 3.1.4.2

##### **indirect pointing**

using system visual feedback to hit a target

##### EXAMPLE

When the system is controlling a screen pointer in response to a mouse movement.

##### 3.1.5

##### **selecting**

choosing one or more items on a display

#### 3.1.6 Touch strategies

##### 3.1.6.1

##### **first-contact touch strategy**

actuation of display area upon touching the display surface

##### 3.1.6.2

##### **last-contact touch strategy**

actuation of display area upon withdrawing touch from the display surface

##### 3.1.7

##### **tracing**

following the outline of an image by moving the cursor or input device over the lines or shape of an image

##### 3.1.8

##### **tracking**

moving a pointer or predefined symbol across the surface of a display screen in order to follow a target



## 3.2 Feedback

### 3.2.1

#### feedback

indicators (such as tactile, auditory or visual) sensed by a user of an action (such as movement or actuation of an input device)

NOTE Display feedback refers to a change on the display resulting from an input device movement or activation.

#### 3.2.1.1

##### kinesthetic feedback

action perceived by the mechano-receptors in joints, muscles, and tendons resulting in awareness of position, movement, weight, and resistance of the limbs or other body parts

#### 3.2.1.2

##### tactile feedback

indication of the results of a user action transmitted through the sense of touch

## 3.3 Hardware

### 3.3.1

#### button

mechanical object integrated into an input device, which responds to force when depressed, and provides input to the computer

### 3.3.2

#### goniometer

instrument which measures the angle of the joints

### 3.3.3

#### input device

user-controlled device that transmits information to a system

### 3.3.4

#### joystick

lever mounted on a fixed base (see Figure 1) used to control the movement of objects displayed on a screen and which controls the relationship between the force or movement applied to the lever and the movement of a pointer

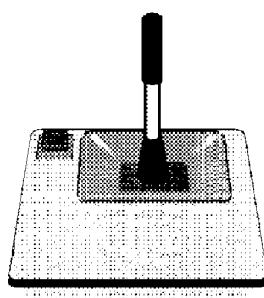


Figure 1 — Side view of example of a joystick

#### 3.3.4.1

##### 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

3.3.5

**light-pen**

light-sensitive input device that, when pointed onto a specific location on a display, identifies its position to the system (see Figure 2)

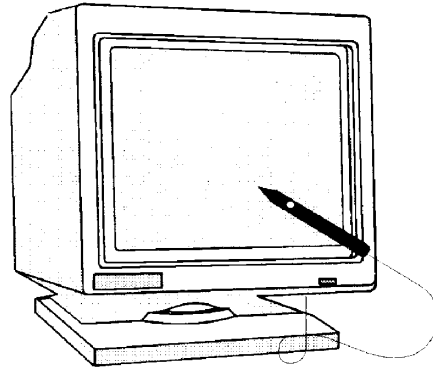


Figure 2 — Example of a light-pen against a display

3.3.6

**mouse**

computer input device having one or more buttons and capable of two-dimensional rolling motion which can drive a cursor on the display and performs a variety of selection options or commands

3.3.7

**overlay**

thin template on the surface of a tablet (see Figure 3) used to indicate the graphic functions available to the user

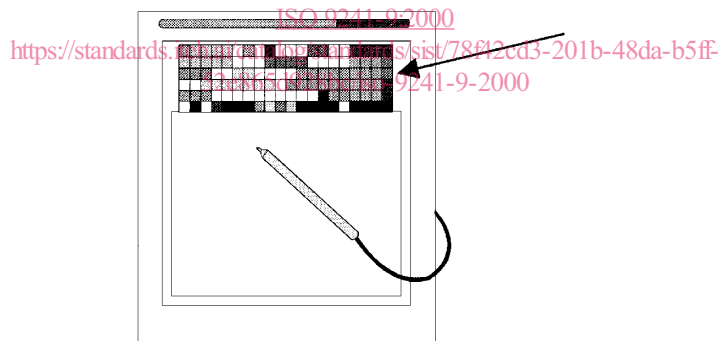


Figure 3 — Top view of example of a tablet with a graphic overlay (indicated by arrow)

3.3.8

**palm rest**

surface which supports the palm of the hand when using an input device (see Figure 4)

NOTE A palm rest is smaller than a wrist rest which provides support for both the palm and wrist, or the wrist only.

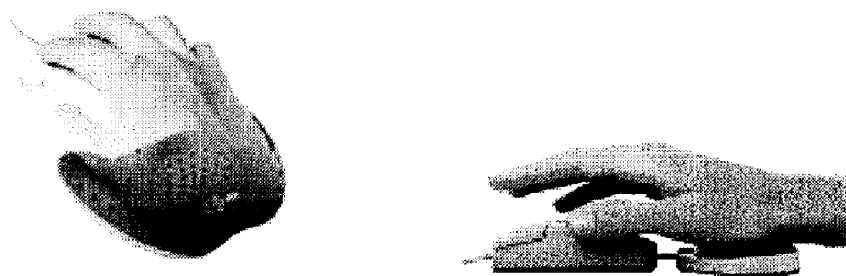


Figure 4 — Top view and side view examples of palm rests used with mice

### 3.3.9

#### pointer

symbol on a display which indicates the input or selection position whose movement is controlled by an input device

### 3.3.10

#### puck

hand-held device similar to a mouse but with a reticle view port and that is typically used with a digitizing tablet (see Figure 5)



Figure 5 — Top view examples of two types of pucks

### 3.3.11

#### reticle

orthogonal lines in the lens of a puck used to visually align the puck to an image (see Figure 6)

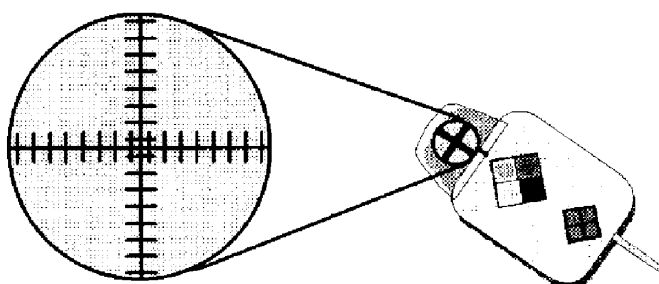


Figure 6 — Top view of example of a puck with reticle (indicated in exploded view on left)

### 3.3.12

#### selector button

actuator located on an input device

3.3.13

**stylus**

pen-shaped pointing device which, when touched to a display or graphics tablet (see Figure 7), can be used to draw images on a display or select displayed objects typically by depressing the stylus tip or actuating a button located along the side of the stylus

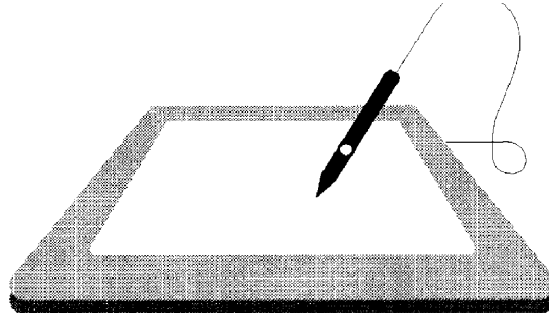


Figure 7 — Side view of example of a stylus over a graphics tablet

3.3.14

**tablet**

special flat surface with an input device (such as a stylus or puck) for selection, drawing, or indicating position of images to be displayed (see Figure 3)

3.3.15

**touch-sensitive screen (TSS)**

input device that produces a position and selection input signal from a finger touching, lifting off, or moving across a display

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3.3.16

**trackball**

ball in a fixed housing that can be rolled in any direction by the fingers to control pointer movement, and that often has adjacent buttons (see Figure 8)

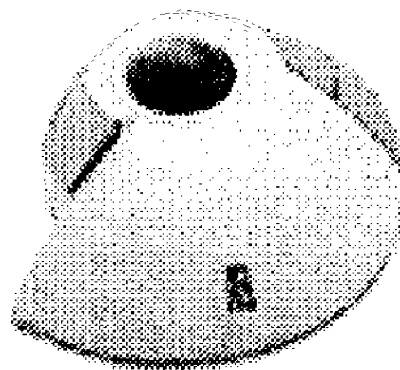


Figure 8 — Example of top view of a trackball device with buttons

3.3.17

**workstation**

assembly comprising display equipment with or without a central processing unit, which may be provided with a keyboard and/or input device and/or software determining the operator/machine-interface, optional accessories, peripherals and the immediate work environment

[ISO 9241-5:1998]

## 3.4 Measures

### 3.4.1

#### **biomechanical load**

effect of work posture and effort on the musculo-skeletal system

### 3.4.2

#### **colour difference**

difference between two colour stimuli, defined as the Euclidean distance between the points representing them in the CIE 1976  $L^*u^*v^*$

NOTE See ISO 9241-8:1997.

### 3.4.3

#### **design reference posture**

posture specified for the purpose of workstation design to define relative positions and dimensions

[ISO 9241-5:1998]

### 3.4.4

#### **design viewing distance**

distance or range of distances (specified by the display supplier) between the screen and the operator's eyes for which the images on the display meet the requirements of this part of ISO 9241, such as that character size, raster modulation, fill factor, spatial instability (jitter) and temporal instability (flicker)

NOTE Adapted from ISO 9241-3:1992.

### 3.4.5

#### **gain**

relationship of the movement or change of an indicator on a display to the movement of a control

### 3.4.6

#### **intended user population**

groups 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.

### 3.4.7

#### **movement time**

time to move a pointing device from a start position to a target position excluding stimulus presentation time and button actuation time

### 3.4.8

#### **parallax**

difference in the apparent relative positions of objects when viewed from different points

### 3.4.9

#### **resolution (resolving power)**

smallest detectable movement, or actuation force, of an input device that results in a pointer displacement on a display

### 3.4.10

#### **task primitive**

fundamental action (like pointing, selecting and dragging) associated with using a non-keyboard input device

NOTE User tasks contain a mix of task primitives.

### 3.4.11

#### **throughput**

measure of the rate of information transfer when a user is operating an input device to control a pointer on a display

NOTE Throughput is measured in bits per second.

### 3.5 Posture

#### 3.5.1

##### **abduction of the arm**

lateral moving or turning of the arm away from the body and position of arm and shoulder after this movement

#### 3.5.2

##### **adduction of the arm**

lateral moving or turning of the arm towards the body, and position of arm and shoulder after this movement

#### 3.5.3

##### **deviation**

moving or turning of the hand in its own plane away from the axis of the forearm, and position after this movement

#### 3.5.4

##### **displacement**

change of position in the location of a point with respect to some reference coordinate

#### 3.5.5

##### **dorsal**

pertaining to the back of the hand (see Figure 9)



Figure 9 — Dorsal view of hand

#### 3.5.6

##### **extension**

moving a limb segment in the dorsal direction, and position of the segment and joint after this movement (see Figure 10)

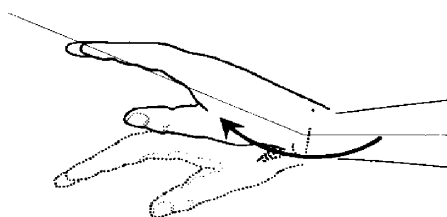


Figure 10 — Example of hand extension

#### 3.5.7

##### **flexion**

moving a limb segment in the ventral direction (for example, moving the hand and fingers toward the palm) and position of the segment and joint after this movement (see Figure 11)

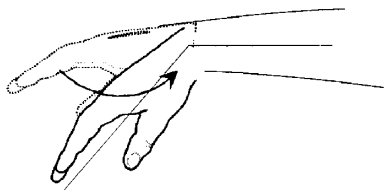


Figure 11 — Hand flexion

### 3.5.8

#### neutral posture

position that the body (and parts of the body) assumes when completely relaxed, that is, without any intentional bending at the joints

### 3.5.9

#### palm

ventral area of the hand between wrist and base of fingers (see Figure 12)



Figure 12 — Palmar area (indicated by the circle) of the hand

### 3.5.10

#### pronation

medial rotation of the forearm (see Figure 13)

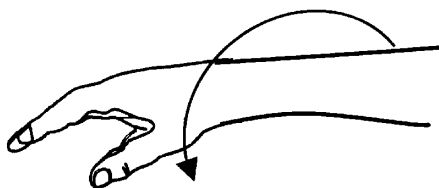


Figure 13 — Pronation (rotation indicated by arrow)

### 3.5.11

#### radial hand deviation

bending the hand at the wrist in the direction of the thumb (see Figure 14)