TECHNICAL REPORT

ISO/TR 9241-308

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Ergonomics of human-system interaction —

Part 308: Surface-conduction electron-emitter displays (SED)

Ergonomie de l'interaction homme-système —

Partie 308: Écrans à émission d'électrons par conduction de surface (SED)

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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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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/TR 9241-308 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 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 110: Dialogue principles*

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

— *Part 171: Guidance on software accessibility*

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

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

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

For the other parts under preparation, see Annex A.

Introduction

This part of ISO 9241 introduces surface-conduction electron-emitter display (SED) technology into the ISO 9241 series and international ergonomics standardization (it is not yet addressed in ISO 9241-307, for instance, or in other ergonomics standards), and has been developed as a set of initial guidelines for the assessment of the ergonomic properties of SED-based products.

Compared with other display technologies, the ergonomic advantages of SED are

— isotropic behaviour of emission of light like that of CRT (cathode ray tube) technology,

— no curvature, unlike CRT technology,

— fast response time, like CRT technology, and

— a uniform and sharp focus on the entire screen as with LCD (liquid crystal display) and PDP (plasma display panel) technologies.

The currently known disadvantages of SED are

— limited display size, from 36 inch upwards (with the potential in the future for smaller display size), and

— fixed resolution compared with CRT technology.

In relation to the ergonomic requirements given in ISO 9241-303 and compared with (for example) CRT, no other specific health aspects or disadvantages of SED technology had been identified at the time of publication of this part of ISO 9241.

Ergonomics of human-system interaction —

Part 308:
Surface-conduction electron-emitter displays (SED)

1 Scope

This part of ISO 9241 gives guidelines for surface-conduction electron-emitter displays (SED).

2 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the following term and definition, symbols and abbreviated terms apply.

2.1
surface-conduction electron-emitter display
SED
emissive visual display for direct view

NOTE See Reference [1].

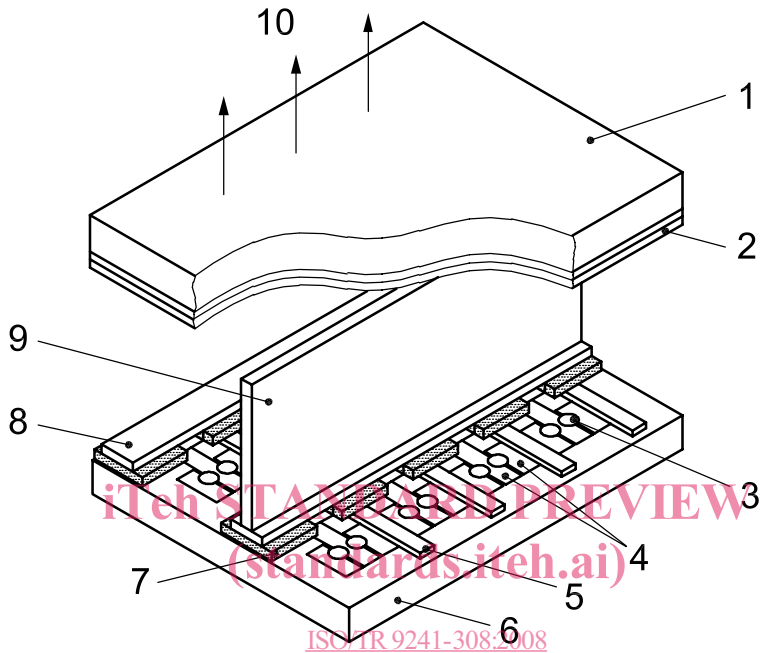
2.2 Symbols and abbreviated terms

A_{scan}	amplitude of scan signal
A_{sig}	amplitude of pulse width modulation signal
$D_{design,view}$	design viewing distance
d	distance between rear and face plates
W_{view}	horizontal display size (width of active display area)
H_{view}	vertical display size (height of active display area)
I_e	emission current
V_a	anode voltage
V_f	driving voltage
AR	anti-reflective
BM	black matrix
CRT	cathode ray tube
LCD	liquid crystal display
PDP	plasma display panel
RD	residual dispersion
SCE	surface-conduction electron-emitter

3 SED technology

3.1 General

The SED panel has a structure as shown in Figure 1. It consists of three main parts: rear plate, face plate and spacers. The spacers allow a vacuum without change in the confined space and are arranged at an appropriate distance, d, between the rear and face plates, the accuracy of this distance having no effect on the SED's visual ergonomics.

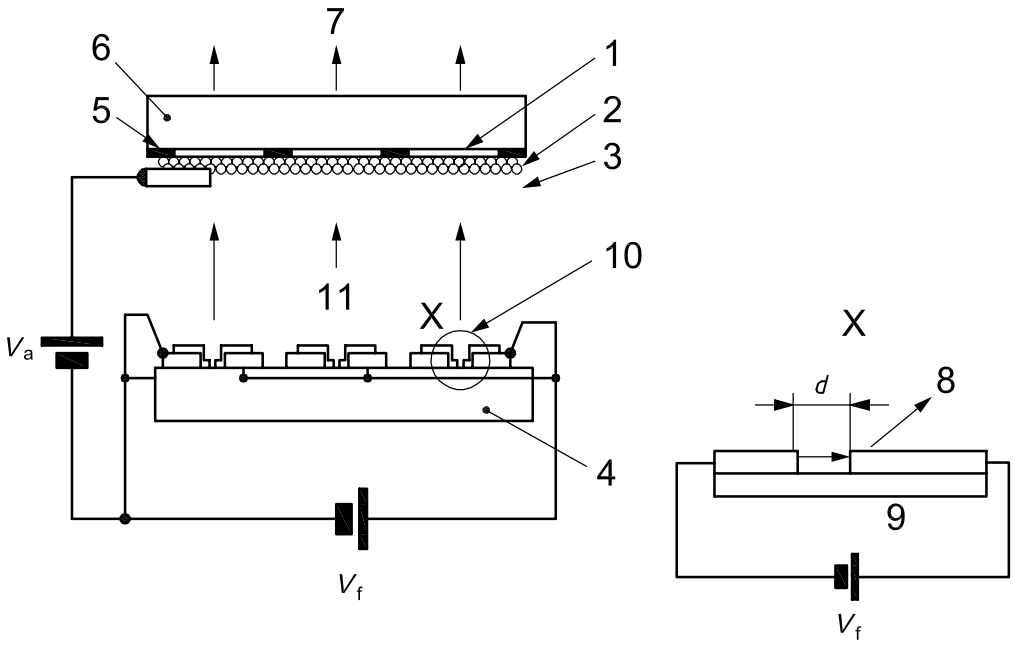


Key

1	face plate	6	rear plate
2	phosphors/metal back film	7	insulator
3	electron emitter	8	scanning wire
4	electrode	9	spacer
5	signal wire	10	luminescence

Figure 1 — SED panel structure

Electrons emitted from surface-conduction electron-emitters (SCE) (see Figures 2 and 3) at a driving voltage, V_f, biased between a pair of electrodes, are accelerated by an anode voltage, V_a. Luminescence from phosphors is extracted through colour filters. The panel operation is summarized in Figure 2.



Key

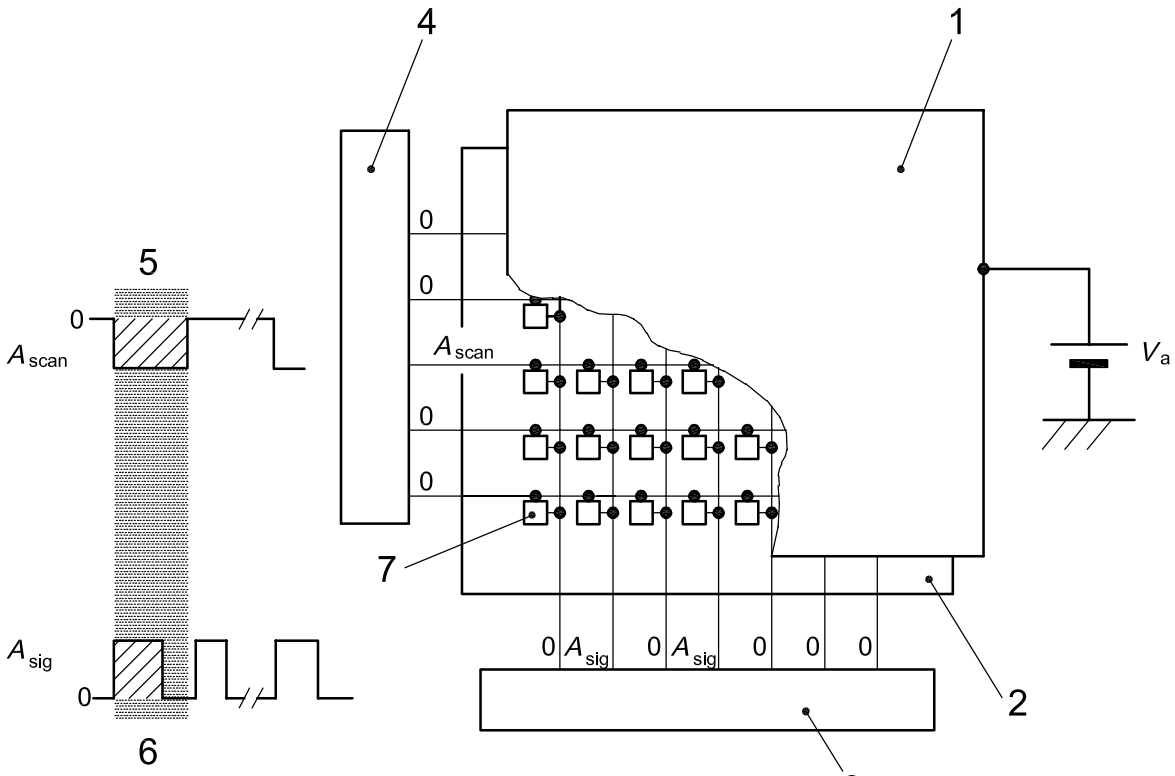
1	colour filter	7	luminescence
2	phosphor	8	electron beam
3	metal back film	9	field emission
4	rear plate	10	SCE
5	black matrix	11	emission current, I_e
6	face plate		
d	distance (a few nanometres)		
V_a	anode voltage		
V_f	driving voltage		

Figure 2 — SED panel operation

3.2 Rear plate

SCE, pairs of electrodes, scanning and signal wires are laid out in a matrix on a glass substrate. The emission current of the SCE is controlled only by V_f at a constant V_a. The diode mechanism of the SCE operation requires only a simple matrix structure for the emitter array.

The SED is driven by line sequential scanning, as shown in Figure 3. The scanning circuit generates the scan signal, the amplitude of which is A_{scan}, and the signal modulation circuit generates a pulse width modulation signal (amplitude, A_{sig}) which is synchronized with the scan signal.



Key

1	face plate	5	scan signal
2	rear plate	6	modulation signal
3	signal modulation driver	7	SCE
4	scanning driver		

A_{scan} amplitude of scan signal

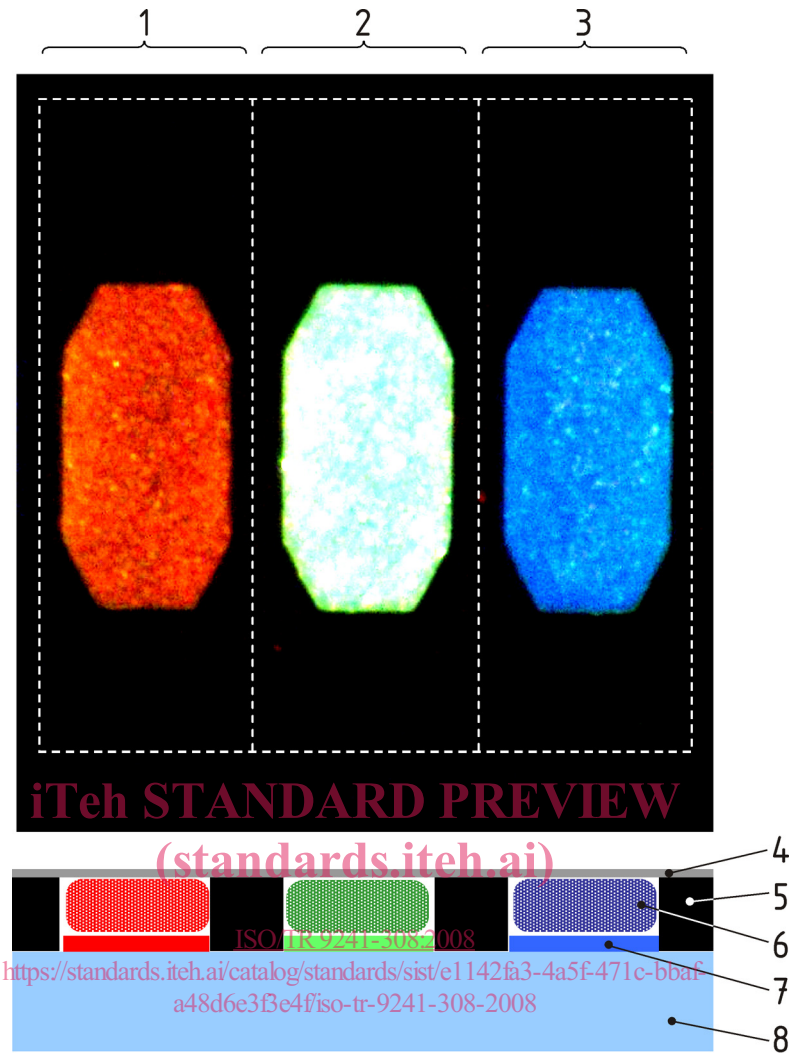
A_{sig} amplitude of pulse width modulation signal

V_a anode voltage

Figure 3 — SED driving method

3.3 Face plate

The face plate consists of black matrix (BM), colour filters, phosphors and a metal (aluminium) back. P22 phosphors are adopted to realize a CRT grade colour gamut. Colour filters play the roles of reducing diffuse reflectance and improving colour purity, with the effect of widening the gamut. The BM opening pattern as shown in Figure 4 is designed from the viewpoints of reducing the diffuse reflectance and matching with the electron beam shape.



Key

1	red	5	BM
2	green	6	phosphor
3	blue	7	colour filter
4	metal back	8	face plate

Figure 4 — BM opening pattern