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Železniške naprave - Voznikova kabina - 3. del: Načrtovanje slikovnih zaslonov

Railway applications - Driver's cab - Part 3: Design of displays

Bahnanwendungen - Führerraum - Teil 3: Gestaltung von Führerraumdisplays

Applications ferroviaires - Cabine de conduite - Partie 3 : Conception des affichages

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Railway applications - Driver's cab - Part 3: Design of displays

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document (prEN 16186-3:2020) has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 16186-3:2016+A1:2018.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2016/797/EU.

For relationship with EU Directive 2016/797/EU, see informative Annex ZA which is an integral part of this document.

EN 16186, Railway applications — Driver's cab is written as an EN series on all the aspects to be considered when designing a driver's cab, from anthropometric data and visibility, over the integration of displays, controls and indicators as well as the design of displays to cab layout and access facilities. The background information on the anthropometric data used is provided in CEN/TR 16823 [2].

EN 16186, *Railway applications — Driver's cab* currently consists of the following parts:

— Part 1: Anthropometric data and visibility;

— Part 2: Integration of displays, controls and indicators;

— Part 3: Design of displays;

— Part 4: Layout and access.

prEN 16186-3:2020 includes the following significant technical changes with respect to EN 16186-3:2016+A1:2018:

— Consistency of display application;

— Luminance;

— Appearance of a flashing yellow frame;

— Typography;

— Audible feedback;

— Characterization of the pictograms according to the reversibility of the function by the driver (Table A1);

— Creation or Modification of pictograms 18, 19b, 29, 39b, 95, 109.

Introduction

The requirements of this document, which interface with vehicle functions, have been elaborated with the commitment to respect the standards specifying these functions and in addition to respect the state of the art of other rolling stock functions.

For tracing of requirements a link to CLC/TS 50459 series [3] or the ERA DMI document [4] serving as a source for the related requirements is added.

The reasons for defining the information are as follows:

— achieving harmonized and coherent presentation of information;

— defining Driver-Machine Interface ergonomics that is compatible with agreed interoperable specifications;

— reducing the risk of incorrect operation by a driver working with different trains fitted with displays;

— facilitating train operation with unified ergonomics, hence reducing the cost of driver training.

Information designed according to this document is deemed to fulfil the following basic principles:

— be clear, correct and necessary;

— indicate its priority, whether by positioning, size, colour, sounds, sound levels, etc.;

— minimize confusion of the driver;

— prevent unnecessary distraction of the drivers' attention while performing their normal duties.

If a requirement contains an option, the choice of this option is purely up to the applicant.

NOTE   The term "option" is to be understood as a possibility that is usually expressed by the word "can".

1 Scope

This document specifies all necessary design rules and associated assessment criteria as well as guidance concerning the design of information and the corresponding user interfaces of driver's cabs of EMU, DMU, Railcars, Locomotives and Driving trailers.

NOTE 1 This document applies to rolling stock in the scope of the Directive 2008/57/EC.

It considers the tasks the driver has to carry out and human factors. This document specifies how information is arranged and displayed. It is explicitly applicable to display applications like TRD, ETD, CCD and TDD and may be completed by the CLC/TS 50459 series.

This document is not applicable to legacy ATP systems. If requirements in this document are in conflict with the ERA DMI document (ERA_ERTMS_015560) the requirements of the ERA DMI document should prevail for the CCD ETCS application.

NOTE 2 For resolving any discrepancies (e.g. 5.4.2.3) ERA is expected to harmonize the usage philosophy of the ERA DMI with this document.

All assessments based on the normative requirements of this document are applicable mainly to

— symbols provided by Annex A,

— arrangement of screen areas conform with Figure 1 (generic organization of information),

— colours, fonts,

— audible information.

This document is applicable to the following aspects:

— legibility and intelligibility of displayed information: general rules concerning the layout of information on the displays, including character size and spacing;

— definition of harmonized colours, symbols, etc.;

— definition of harmonized principles for the command interface (by physical or touchscreen buttons): size, symbols, reaction time, way to give feedback to the driver, etc.;

— general arrangements (dialogue structures, sequences, layout philosophy, colour philosophy), symbols, audible information, data entry arrangements.

NOTE 3 If this document deals with how information can be given for operation and in degraded situations, it does not define operating rules and degraded situations.

This document does not request any safety requirement related with displayed information.

This document specifies minimum requirements and does not prevent more complex solutions.

Requirements describing the functions using the display are out of scope of this document.

This document is not intended to be applicable for tramway, metros and light rail vehicles.

2   Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

CLC/TS 50459-2:2015, *Railway applications - Communication, signalling and processing systems - European Rail Traffic Management System - Driver-Machine Interface - Part 2: Ergonomic arrangements of GSM-R information*

CLC/TS 50459-3:2016, *Railway applications - Communication, signalling and processing systems - European Rail Traffic Management System - Driver-Machine Interface - Part 3: Ergonomic arrangements of non ETCS information*

EN 894-2:1997+A1:2008, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 2: Displays*

EN 14198:2016+A1:2018, *Railway applications — Braking — Requirements for the brake system of trains for general operation*

EN 16186-1:2014+A1:2018, *Railway applications - Driver's cab - Part 1: Anthropometric data and visibility*

EN 16186-2:2017, *Railway applications - Driver's cab - Part 2: Integration of displays, controls and indicators*

EN 16334:2014, *Railway applications - Passenger Alarm System - System requirements*

EN 16683:2015, *Railway applications - Call for aid and communication device - Requirements*

EN ISO 9241-307:2008, *Ergonomics of human-system interaction - Part 307: Analysis and compliance test methods for electronic visual displays (ISO 9241-307:2008)*

ISO 2575:2010, *Road vehicles — Symbols for controls, indicators and tell-tales*

3   Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16186-1, EN 16186-2:2017 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
activated
put into a functional state following a validated input

3.2
authentication
process checking the identity of the user, device or any other element of the system or integrity of the stored, transmitted or retrieved/exposed data

Note 1 to entry: This may be a pre-requisite to access the system.

3.3
authorisation
process granting the access rights to a user, program or process, or an event or status of the system putting the system itself in hold condition which can be exited only by the action of authorized staff

3.4
brightness
attribute of a visual sensation according to which an area appears to emit more or less light

Note 1 to entry: The use of this term is not restricted to primary light sources.

[SOURCE: ISO 9241-302:2008, definition 3.3.9, modified (Note added)]

3.5
button
operating element for interaction with the display (hard key, soft key, sensitive area)

3.5.1
enabled
put into a state where the function related to the button can be activated by pressing the button

3.5.2
pressed
put into a state where the action on the button is ongoing

3.6
cell
basic unit to define the shape of DMI objects and the proportions of areas

Note 1 to entry: Depending on the resolution of the screen, a cell consists of one or more pixels.

3.7
Closed Circuit Television
CCTV
television allowing the transmission of images over a relatively short distance intended for a particular group of users

[SOURCE: IEC 723-01-19, modified "generally by cable" removed]

3.8
display
hardware device or system that shows text and/or graphic information to the user

Note 1 to entry: The display optionally contains hard keys.

3.9
command
action executed by the personnel on the human-machine interface

3.10
consistency
maintenance of interface design choices (codes, naming, formats, procedures, etc.) in similar contexts

Note 1 to entry: see [5].

3.11
control and command display
CCD
device that shows information from automatic train control or protection systems (ETCS and national systems) as well as information from the TCMS

3.12
electronic timetable display
ETD
operator option that shows information and allows interaction regarding the electronic timetable sheet

3.13
error
deviation from the intended design which could result in unintended system behaviour or failure

[SOURCE: EN 50129:2003, 3.1.15]

3.14
event
occurrence of a state at a defined precondition and time requesting attention, e.g. alarm, authentication, authorisation, fault, warning

[SOURCE: EN 15380-4:2013, 3.12, modified ("requesting attention, e.g. alarm, authentication, authorisation, fault, warning" added)]

3.15
failure
deviation from the specified performance of the system

[SOURCE: EN 50129:2003, 3.1.17, modified]

3.16
fault
abnormal condition which could lead to an error

[SOURCE: EN 50129:2003, 3.1.18, modified]

3.17
grid array
area consisting of cells which results in a visual appearance of information in certain proportions

Note 1 to entry: Form and shape of the information on the screen in this standard is based on a graphical screen with a total grid array of 640 x 480 rectangular cells. This ratio forms the basis for all object proportions independent of resolution and size of the screen.

3.18
hard key
physical key with permanent marking and not part of the screen area

Note 1 to entry: This permanent marking may be alpha and/or numeric and/or a symbol.

3.19
input field
highlighted screen area for entering data

3.20
label
symbol or text indication on or close to an indicator or a button

EXAMPLE: Soft key label

3.21
luminance
physical measurement of the stimulus which produces the sensation of brightness, in terms of the luminous intensity in a given direction (usually towards the observer), per unit area, of an emitting, transmitting or reflecting surface, expressed in candelas per square metre (cd/m^2)

Note 1 to entry: It is the luminous intensity of the light emitted or reflected in a given direction from an element of the surface divided by the area of the element projected in the same direction.

[SOURCE: ISO 11064-6, 3.9, modified: (cd/m^2) added, notes 2 and 3 removed.]

3.22
pilot pressure
pressure existing at the pneumatic relay of the driver's brake valve

3.23
redundancy concept
display concept that ensures the display of information of a display out of order on one or more of the other operational display(s)

3.24
remedy
help and/or explanatory information related to a technical fault

3.25
RGB
colour scheme defined in EN 61966-2-1

3.26
screen
visual result of software, implemented on a display that is devoted to interact with the user

Note 1 to entry: A screen is a set of information made of a background, windows and symbols. This information may be for example speed, distance, pressure, temperature, electric current, real time video images, which may allow or request drivers to input data through a user interface

3.27
screen area
part of display providing the screens

3.28
sensitive area
enabled area on a touchscreen on which a physical action is possible in order to give input to the display

3.29
soft key
context-dependent key consisting of a combination of a hard key and an associated screen label (text or symbol)

Note 1 to entry: This key is for multifunctional use.

3.30
standstill ($v = 0$)
condition under which the vehicle speed has decreased to 3 km/h or less

3.31
status
existent or potential state of the system or actual state at a given time t

Note 1 to entry: A status may be: a) ON/active/up, b) OFF/inactive/down, c) excluded, d) faulty

3.32
symbol
pictorial representation (with optional digits and letters) used for displaying information

3.33
technical and diagnostic display
TDD
device that provides information and recommendations with regard to train and/or vehicle status, diagnostics, failure management and dedicated functions of the vehicle or the entire train

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3.34
technical specification

document describing specific parameters and/or product requirements, which have to be agreed by contracting parties

3.35
text
alphanumeric information

3.36
title
text explaining the purpose of the window or screen

3.37
Train Control and Monitoring System
TCMS
means of controlling and monitoring functions of the train internally, whether by software or hardware, and of providing information to the driver of the status of equipment on-board the train

3.38
train mission
train running number and start and end of train run, provided the train composition is not changed

3.39
train radio display unit
TRD
device that provides information and interaction regarding the train radio

3.40
troubleshooting
process of structured and intentional activities in order to cope with a technical problem with support of the diagnostic system

3.41
window
separate visual area of the screen which displays information output and may allow input

Note 1 to entry: Usually it has a rectangular shape.

4   Symbols and abbreviations

CCTV	Closed Circuit Television
DAC	Driver Activity Control
DMU	Diesel Multiple Unit
EMU	Electrical Multiple Unit
ep	electro-pneumatic
ETCS	European Train Control System
MCB	Main Circuit Breaker
PAD	Passenger Alarm Device
PAS	Passenger Alarm System
TCMS	Train Control and Monitoring System
WSP	Wheel Slide Protection

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5   Characteristics of displays and visible or audible information

5.1 General

5.1.1 General guidelines

5.1.1.1 Robustness

Any protection against mechanical damage should not adversely affect the visibility of any displayed information.

5.1.1.2 Consistency of display application

Information that require driver's action shall be presented only once (except for speed indication). Existing data shall be consistently available for all displays where relevant, but each piece of information (e.g. time) should be only shown in one display. In case a piece of information is shown on more than one display (or other devices), the delay between the visualization of the information on the displays shall not exceed 1 s

5.1.1.3 Design principles

All displays and displayed applications should be designed according to consistent principles and therefore have a common approach for the user interface.

The following principles should govern graphical user interface design:

— symbols should be used consistently with their meaning (same information = same symbol);

— all driving related displayed information should be located in the preferred field of vision (see EN 16186-2:2017, Figure A.2);

— high priority visual information requiring immediate action shall be more prominently displayed and shall be accompanied by an alerting tone;

— each window should have an explicit title;

— numerical values should be displayed using standard units and SI standard prefixes (e.g.: voltage in V, mV, kV etc.);

— when two symbols (e.g. a needle and a figure) represent the same piece of information on a screen, the same colour shall be used for both unless they physically overlap;

NOTE   The symbols in Annex A follow these general rules. Further information related with the symbols is provided in Annex A.

5.1.1.4 Information objective

The information provided should be adapted to the phase of driving and the state of the train. The principle of "just enough" at the right time should drive the design of the screens.

5.1.1.5 Suppression of information

Information that does not affect the driving task should be suppressed unless specifically selected.

5.1.2 Provide operation relevant information

5.1.2.1 Energy consumption information

If energy measuring function or other information on the energy consumption is available, information may be provided e.g. on the TDD or ETD.

5.1.2.2 Driver advice

If driver advice is available, this information may be provided e.g. on the TDD, ETD, CCD or TRD.

5.1.2.3 Lubrication information

If lubrication of wheel flange is available, the related information should be provided on the TDD.

5.1.2.4 Exterior lighting diagnostic

If a system is available for monitoring continuously the head, marker and tail lights, an interface shall be provided to indicate light failure to the driver.

5.1.3 Display performance requirements

5.1.3.1 Principle of presenting information

5.1.3.1.1 General

All information should be organized into functional groups that contain related items of information. Such relationships should be based on logical or functional considerations:

a)   Critical information