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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 Führerraumanzeigen

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

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ICS:

45.060.10 Vlečna vozila Tractive stock

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

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3: Conception des affichages

Bahnanwendungen - Führerraum - Teil 3: Gestaltung
von Führerraumanzeigen

This European Standard was approved by CEN on 12 June 2016 and includes Amendment 1 approved by CEN on 26 August 2018.

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COMITÉ EUROPÉEN DE NORMALISATION
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EN 16186-3:2016+A1:2018 (E)**European foreword**

This document (EN 16186-3:2016+A1:2018) has been prepared by Technical Committee CEN/TC 256 "Railway applications", 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of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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

This document includes Amendment 1 approved by CEN on 2018-08-26.

This document supersedes EN 16186-3:2016.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

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 2008/57/EC [1].

For relationship with EU Directive 2008/57/EC, 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;
- **A1** Part 4: Layout and access. **A1**

A1 Deleted text **A1**

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The requirements of this standard, 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;
- to reduce 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 standard 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".

EN 16186-3:2016+A1:2018 (E)**1 Scope**

This European Standard 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 standard 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 standard 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 standard is not applicable to legacy ATP systems. If requirements in this standard 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 standard.

All assessments based on the normative requirements of this standard 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.

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This standard 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 standard deals with how information can be given for operation and in degraded situations, it does not define operating rules and degraded situations.

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

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

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

A1 This standard is not intended to be applicable for tramway, metros and light rail vehicles. **A1**

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *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, *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*

prEN 14198:2014, *Railway applications — Braking — Requirements for the brake system of trains for general operation*

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

prEN 16186-2:2015, *Railway applications — Driver's cab — Part 2: Integration of displays, controls and indicators*

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

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

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

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 and prEN 16186-2:2015 and the following apply.

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

EN 16186-3:2016+A1:2018 (E)**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.

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3.7**Closed Circuit Television****CCTV**

television allowing the transmission of images over a relatively short distance intended for a particular group of users

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[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

EN 16186-3:2016+A1:2018 (E)**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

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

EN 16186-3:2016+A1:2018 (E)**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

An application using a display should be consistent with all applications on all displays used for driving.

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 displayed information should be located in the preferred field of vision (see prEN 16186-2:2015, Figure A.2);
- high priority visual information requiring immediate action should be more prominently displayed and should 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 should 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