



BSI Standards Publication

Railway applications — Driver's cab

Part 3: Design of displays for heavy rail vehicles

National foreword

This British Standard is the UK implementation of EN 16186-3:2022. It supersedes BS EN 16186-3:2016+A1:2018, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RAE/4/-/4, Railway Applications - Driver's Cab.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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European foreword

This document (EN 16186-3:2022) 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of an identical text or by endorsement, at the latest by September 2022, and conflicting national standards shall be withdrawn at the latest by September 2022.

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 supersedes EN 16186-3:2016+A1:2018.

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 [1].

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 for heavy rail vehicles;*
- *Part 4: Layout and access;*
- *Part 5: External visibility for tram vehicles;*
- *Part 6: Integration of displays, controls and indicators for tram vehicles ¹⁾;*
- *Part 7: Design of displays for tram vehicles ²⁾;*
- *Part 8: Tram vehicle layout and access.*

EN 16186-3:2022 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;

¹⁾ Under preparation. Stage at the time of publication: prEN 16186-6:2022.

²⁾ Under development.

- audible feedback;
- characterization of the pictograms according to the reversibility of the function by the driver (Table A.1);
- creation or modification of pictograms 18, 19b, 29, 39b, 46b, 95, 109.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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 the tracing of requirements, a link to CLC/TS 50459 series [2] or the ERA DMI document [3] 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.

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 1 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 conforms to 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 2 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 applies to driver's cabs of locomotives and driving vehicles of the heavy rail system.

EXAMPLES Locomotives, railcars, power heads, driving trailers.

This standard is not applicable for vehicles of urban rail systems.

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 50459-2:2021, *Railway applications — Communication, signalling and processing systems — European Rail Traffic Management System — Part 2: Ergonomic arrangements of GSM-R information*

CLC/TS 50459-3:2021, *Railway applications — Communication, signalling and processing systems — European Rail Traffic Management System — 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+A2:2021, *Railway applications — Braking — Requirements for the brake system of trains hauled by locomotives*

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)*

EN ISO 9241-303:2011, *Ergonomics of human-system interaction — Part 303: Requirements for electronic visual displays (ISO 9241-303:2011)*

ISO 2575:2021, *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 16186-1:2014+A1:2018, 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 <https://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 can 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: EN 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 60050-723:1997, 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 [4].

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

<of an item> loss of ability to perform as required

[SOURCE: IEC 60050-192:2015, 192-03-01, modified (the Notes 1, 2 and 3 to entry have been omitted)]

3.16

fault

<in a system> state of an item characterized by inability to perform a required function, excluding the inability during preventive maintenance or other planned actions

Note 1 to entry: A fault is often the result of a failure of the item itself, but can exist without prior failure (e.g. in case of a design fault).

Note 2 to entry: The fault is a state characterized by inability to perform a required function.

[SOURCE: IEC 60050-821:2017, 821-11-20, modified – The definition “abnormal condition that could lead to an error in a system” has been changed. The note 1 to entry has been changed and the note 2 to entry has been added.]

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 can 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: EN ISO 11064-6:2005, 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 can 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

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 can 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

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

ACK	Acknowledgment
CCD	Control and Command Display
CCTV	Closed Circuit Television
DAC	Driver Activity Control
DMU	Diesel Multiple Unit
EMU	Electrical Multiple Unit
ep	electro-pneumatic
ETCS	European Train Control System
ETD	Electronic Timetable Display
MCB	Main Circuit Breaker
PAD	Passenger Alarm Device
PAS	Passenger Alarm System
TCMS	Train Control and Monitoring System
TDD	Technical and Diagnostic Display

TRD	Train Radio Display unit
WSP	Wheel Slide Protection

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 requires an action from the driver, shall be presented only once (except for speed indication and information in the area “order and announcement” and in the planning area of ETCS DMI). Existing data shall be consistently available for all displays where relevant. Each piece of information (e.g. time) should be only shown on 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 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);
- visual information requiring immediate action shall be prominently displayed;
- high priority visual information shall be accompanied by an alerting tone. The number of sounds should be minimized;

NOTE 1 High priority information is information that requires immediate action by the driver.

- 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 2 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 continuously monitoring 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

Critical information, such as alarms, should be displayed in dedicated locations. In general, the character size and colour of a particular item of information should depend on the importance of that information.

Other information should be limited in order not to overload or to distract the driver.

b) Audible information

Audible information may be used for prompting the user that input is required but, in general, audible information should be reserved for feedback or critical information.

c) Menus

If a menu structure is provided to locate different functions, the menu should:

- facilitate a selection of quick and easy options relevant for the operational task;
- provide a selection facility which allows the choice of a desired option accurately and unambiguously.

d) Feedback and response times

Visual, audio or tactile feedback should be provided at all times.

The response time of the system to an input should be rapid enough not to be perceived as a delay in the workflow.

If the response time of the system is by design longer than 600 ms for a simple function, or 2 s for a complex function, and if there is no other feedback from the system, then the waiting symbol should be displayed. If appropriate, the symbol can be replaced by text (see Table A.1, Pos. 60).

5.1.3.1.2 Time to change screens

Notwithstanding the processing time of the application, the maximum time to change screens should not exceed 1 s.

5.1.3.1.3 Display response time

The time between the reception of new data and the update of the screen display image should not exceed 200 ms.

5.1.3.1.4 Degradation of displays

The system shall provide feedback to enable detection of malfunction that will have an impact on the reliability of the information displayed (e.g. frozen image displayed on the screen). The time information (in s) displayed on the different screens may be used as a means to detect failures.

A redundancy concept may be provided as an option.

In case of a display failure, the essential data for operating the train from two display screens may be merged into one.

5.1.3.1.5 No reverse impact of a display failure

The failure of one display shall not impair the function of any other display.

5.1.3.1.6 Design of screen area

The screen area shall meet the requirements of pixel failure type 2 and shall be designed in accordance with EN ISO 9241-307:2008.

5.1.3.1.7 Data consistency

If displays are connected by data communication, data shall be available in a consistent way for all displays.

5.1.4 Principles for warnings

5.1.4.1 Content of warnings

The content of warnings should include information on:

- a) titles of the warnings, their form, what they indicate and what response they require;
- b) the levels of priority;
- c) any coding systems that are employed.

Audible warnings inside the cab should be distinctive and have loudness and sound qualities, according to their functions, urgency and importance. This principle applies for all applications in the cab.

Visual warnings inside the cab should be distinctive and have light intensities, according to their functions, urgency and importance. This principle applies for all applications in the cab.

5.1.4.2 Priority levels

If different levels of priority are used, e.g. high, medium, low, warnings shall be displayed accordingly. Each level of priority shall be defined.

5.1.4.3 Warning design

Consistency

- a) The same type of event occurring should always provide the same type of warning.
- b) A specific type of warning should always require specific response(s).

5.1.4.4 Numbers of visual warnings

The average rate of warnings displayed in normal operation conditions should be less than one in 10 min. The total number of warnings displayed simultaneously should be less than 10, with less than 5 per display.

5.1.4.5 Principles for audible warnings

Audible warnings should meet all the following requirements:

- as far as practicable, be consistent in their meaning;
- be distinguishable from each other;
- be audible from all applicable driving positions and in all driving conditions;
- not cause drivers audible discomfort when sounding;
- use the selected language, if language selection is provided.

NOTE Either a noise or a recorded/synthesized voice is acceptable.

5.1.5 Languages

5.1.5.1 Language selection

If the information can be displayed or sounded in different languages, the possibility to select a language shall be provided.

5.1.5.2 Simultaneous language selection

As an option, the selection of a language in one display may change the language in all displays accordingly.

5.2 Design of information

5.2.1 General

5.2.1.1 General design of displayed information

EN 894-2:1997+A1:2008, 4.2.1, shall apply.

5.2.1.2 Common user interface

The same type of display should be used in a cab for all displays. For example, displays with hard keys and displays with touchscreen should not be mixed.

This may not apply to existing systems, e.g. integrations of new displays in existing driver's cab.

5.2.1.3 Prioritization of information

Prioritization of displayed information (see Annex B) shall be achieved by:

- physical values except for timetable information (e.g. speed, traction or dynamic brake force, brake pipe pressure) to be displayed in normal mode and while running should be between 5 and 15 per display, see Figure H.1;
- only if symbols and text messages are not used as labels of keys: while running the sum of symbols and text messages displayed simultaneously on a single display in normal mode should not be more than 15.

5.2.1.4 Display of indicators

Any indicator should be displayed for at least two seconds, except when a user action leads to deletion of the indicator.

NOTE The flashing frame is not subject to this rule.

5.2.1.5 Audible and/or visual warnings

When a system and/or function intervenes with a driver's task, an audible and/or visual warning shall be given by the display.

5.2.1.6 Use of information

The use of symbols, standardized text messages and audible information shall comply with Annex A and the requirements of this standard.

5.2.1.7 Information provided by functions

All functions applied that shall provide displayed information are given in Table B.1 and Table B.2.

Optional functions applied that shall provide displayed information are given in Table B.3.

NOTE For the functions providing displayed information some informative references dealing with requirements describing those functions are provided by Annex C (Table C.1).

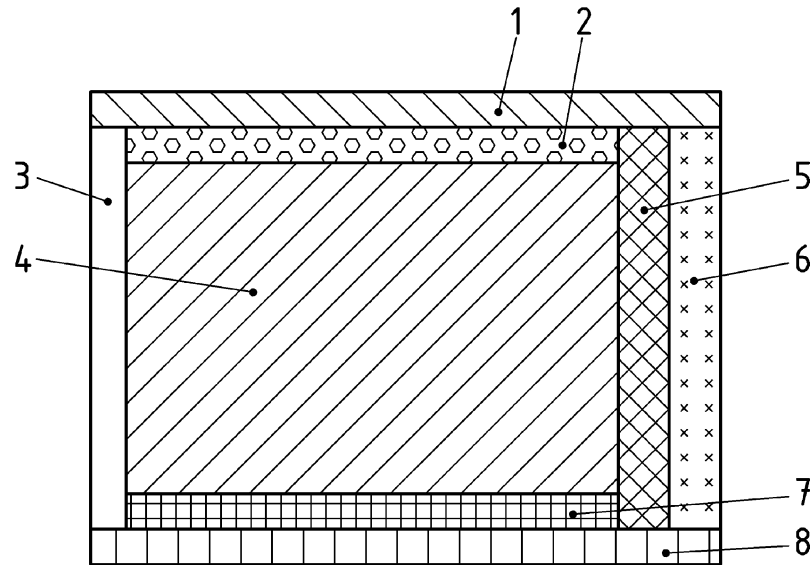
5.2.2 Screen organization and dimensions

5.2.2.1 Organization of screen information

The screen shall be organized as shown in Figure 1.

Use of optional areas and size of all areas in Figure 1 shall depend on the specific requirements of the applications using the display. Touchscreen buttons, if any, can be placed on the entire screen. If hard keys are used, Annex D should apply. TDD information should be structured according to Annex E and Annex F.

Annex I provides an example of the location of the most frequently seen information and Annex H provides existing examples of screen layouts that demonstrate conformity with the principles of this standard.

**Key**

- 1 Option: Headline (text)
- 2 Option: Status line (additional status line, preferably text)
- 3 Option: Function (soft keys)
- 4 Application-specific organization of information (graphic and/or text information)
- 5 Option: Status (additional status line, preferably symbols)
- 6 Option: Function (soft keys ^a) or Status (additional status line, preferably symbols)
- 7 Option: Bottom status line(s): Symbols and text
- 8 Function (soft key labels or touchscreen buttons)

^a preferably for navigation and validation (acknowledgement). Within the same screen navigation and/or validation may not be permanently provided. Then the soft keys show the enabled functions of the related hard keys.

Figure 1 — Display screen organization

5.2.2.2 Screen size

The diagonale of the screen shall be at least 10,4". The ratio should be 4:3 or 16:9 or 16:10.

5.2.2.3 Combination of screens

The visual appearance of displayed information shall be kept even if it is provided by a combination of screens.

5.2.2.4 Minimum resolution

The minimum resolution of each display shall be based on a minimum total grid array of 640 × 480 cells.

5.2.2.5 Headline height

If provided, the height of the headline area shall be at least 8 mm.

NOTE This height is linked to the distance of the driver's eye to the display according to 5.2.6.4.

5.2.2.6 Headline text

If provided, the headline shall contain text indicating which kind of information is given or requested.

For better readability the headline should be centred.

NOTE The text can also contain an indication regarding the hierarchy of screens.

5.2.3 Luminance

5.2.3.1 Range of luminance

The screen shall have a high luminance with a minimum of 250 cd/m². The screen shall have a low luminance between 0,5 cd/m² and 30 cd/m² measured on a white background for both values.

5.2.3.2 Adjustability of luminance

The adjustability of screen luminance by at least 10 equivalent steps shall be between the low and the high luminance according to 5.2.3.1, measured on a white background for both values. Luminance shall be ensured over a large angular field range (at least: vertically $\pm 45^\circ$, horizontally $\pm 35^\circ$ relative to the perpendicular direction of the display surface).

5.2.3.3 Automatic adjustability of luminance

The display shall be able to automatically adjust the luminance of the screens related to the ambient light.

The automatic adjustment should be set when starting the display.

It should be prevented that the manually adjusted luminance is overridden by the automatic adjustment. Automatic adjustability of luminance should allow a combination of automatic adjustment with a manual delta.

The automatic adjustment shall also take into account fast luminance changes (e.g. going in and out of a tunnel).

5.2.3.4 Illumination of hard keys

The hard keys of an activated display shall be identifiable in darkness.

NOTE This is deemed to be fulfilled by the desk light (see Annex B of EN 16186-2:2017, Pos. 039).

The luminance of the keys with background illumination may be adjusted automatically, related to the ambient light. Reflective keys which always need ambient light are not allowed.

There may be a link between the luminance control of the screens and the luminance control of the hard keys.

5.2.3.5 No flickering

All screens shall be flicker-free at all luminance values according to EN ISO 9241-307:2008.

5.2.3.6 Uniformity of luminance and colours

For all possible ambient lighting conditions, a homogeneous display area with uniform luminance and no colour differences shall always exist.

The uniformity of the luminance (L_{diff} [%] calculated from L_{max} [cd/m²] and L_{min} [cd/m²] as shown below) over the entire display area, for example the white and blue background, should not exceed 25 %.

$$L_{\text{diff}} [\%] = (L_{\text{max}} - L_{\text{min}}) * 100 / L_{\text{max}}$$

The permitted colour tolerance for colour coordinates according to the RGB system is described for each colour in Table 1.

This requirement applies to the entire angular range, where the visibility is required on the display surface

5.2.3.7 Multiple display adjustment

If more than one display is interfacing with TCMS, the luminance of the screens of these displays should be adjustable simultaneously. Selective control should always be possible.

NOTE Manual adjustment supersedes automatic adjustment, see Table A.1, Pos. 8.

5.2.4 Colours

5.2.4.1 Definition of colours

Table 1 — Permitted colours for screens

EN 16186-3 colour ID	EN 16186-3 R	EN 16186-3 G	EN 16186-3 B	Resulting EN 16186-3 colour	Colour name	Absolute range R	Absolute range G	Absolute range B	Resulting EN 16186-3 colour with lower range values	Resulting EN 16186-3 colour with upper range values
1	255	255	255	255, 255, 255	white	240 - 255	240 - 255	240 - 255	240, 240, 240	255, 255, 255
2	0	0	0	0, 0, 0	black	0 - 15	0 - 15	0 - 15	0, 0, 0	15, 15, 15
3	195	195	195	195, 195, 195	grey	192 - 207	192 - 207	192 - 207	192, 192, 192	207, 207, 207
4	150	150	150	150, 150, 150	medium grey	144 - 159	144 - 159	144 - 159	144, 144, 144	159, 159, 159
5	85	85	85	85, 85, 85	dark grey	80 - 95	80 - 95	80 - 95	80, 80, 80	95, 95, 95
6	8	24	57	8, 24, 57	shadow	0 - 15	16 - 31	48 - 63	0, 16, 48	15, 31, 63

EN 16186-3 colour ID	EN 16186-3 R	EN 16186-3 G	EN 16186-3 B	Resulting EN 16186-3 colour	Colour name	Absolute range R	Absolute range G	Absolute range B	Resulting EN 16186-3 colour with lower range values	Resulting EN 16186-3 colour with upper range values
7	3	17	34	3, 17, 34	dark blue	0 - 15	16 - 31	32 - 47	0, 16, 32	15, 31, 47
8	33	49	74	33, 49, 74	dark night blue	32 - 47	48 - 63	64 - 79	32, 48, 64	47, 63, 79
9	41	74	107	41, 74, 107	light night blue	32 - 47	64 - 79	96 - 111	32, 64, 96	47, 79, 111
10	0	0	195	0, 0, 195	blue	0 - 15	0 - 15	192 - 207	0, 0, 192	15, 15, 207
11	180	180	0	180, 180, 0	ochre	176 - 191	176 - 191	0 - 15	176, 176, 0	191, 191, 15
12	223	223	0	223, 223, 0	yellow	208 - 223	208 - 223	0 - 15	208, 208, 0	223, 223, 15
13	234	145	0	234, 145, 0	orange	224 - 239	144 - 159	0 - 15	224, 144, 0	239, 159, 15
14	191	0	2	191, 0, 2	dark red	176 - 191	0 - 15	0 - 15	176, 0, 0	191, 15, 15
15	255	0	0	255, 0, 0	red	240 - 255	0 - 15	0 - 15	240, 0, 0	255, 15, 15
16	255	62	62	255, 62, 62	light red	240 - 255	48 - 63	48 - 63	240, 48, 48	255, 63, 63

NOTE The colour values are software RGB values.

5.2.4.2 Meaning of colours

5.2.4.2.1 Colours used for messages and commands

The meaning of colours used for messages and commands shall be according to Table 2. The colours of letters and numbers do not have specific meanings. Combinations of colours shall comply with Table 3.

Table 2 — Meaning of colours used for messages and commands

Background colours (references to Table 1)	Meaning	Requirements (see also principles for the display of symbols and texts)
1,3,4,5	information	5.2.4.7.2
7	status	5.2.4.7.3 - 5.2.4.7.4
7	buttons	5.2.4.7.5
10	help (do)	5.2.4.7.6
12	request to acknowledge	5.2.4.7.7 - 5.2.4.7.12
12	fault	5.2.4.7.13
14, 15, 16	alarm (act!)	5.2.4.7.14
green	not permitted	5.2.4.4
	data entry	5.2.4.7.15

5.2.4.2.2 Colours used for other purposes

Colour Nos. 2, 6, 9, 11 and 13 are provided for other purposes like driving operation information, e.g. in the TRD and TDD.

5.2.4.3 Colour ID Nos. 12 – 16

Colour ID Nos. 12 – 16 of symbols, letters or backgrounds (see Table 1) should be used conservatively, preferably only in the following circumstances:

- for information which has to be brought to the driver's attention quickly; and
- to assist interpretation of the function as either information about a fault or an alarm which requires immediate action.

5.2.4.4 Colour green

The colour green is not permitted for any displays, except for Class B CCS and for the symbol according to Annex A, Pos. 55.

NOTE The green colour is available for screens that are used only by maintenance people.

Therefore, the G value shall not be greater than the bigger value of R and B.

$$G \leq \max(R, B)$$

5.2.4.5 Screen colours

The 24-bit RGB colour values set out in Table 1 shall be used. Any reference to a colour shall be a reference to this table.

5.2.4.6 Background colour of status icons

Background colour of status icons shall be colour No. 7 from Table 1.

5.2.4.7 Background colour contrast

5.2.4.7.1 General

The background colour should provide sufficient contrast.

5.2.4.7.2 Information to the driver

Symbols shall be white or grey, if no driver action is requested and the colour is not associated with a specific meaning.

NOTE Examples for specific meanings are definition of the main energy system (Pos. 55 in Table A.1) and Head light (Pos. 69 in Table A.1).

5.2.4.7.3 Status and warning information (except for alarms)

Status and warning information (except for alarms) shall be displayed as contrasting text or symbol on background colour No. 7.

5.2.4.7.4 Background colour for the entire screen

Background colour for the entire screen shall be colour No. 7.

5.2.4.7.5 Button background colour

For buttons, colour No. 7 shall be used.

5.2.4.7.6 Help text

Help text shall be used for TCMS (TDD) advice in normal mode (support, guidance) in contrasting text on background colour No. 10.

NOTE Help text is text that helps the driver to understand any information on the display.

5.2.4.7.7 Appearance of a flashing yellow frame

A flashing (2 Hz) yellow frame ("= request to acknowledge within time-frame") shall be shown when an acknowledgement is requested for documenting the reception of information from the technical system.

A frame shall be displayed to the ACK button (also for display with softkey technology). If there is a need to draw the attention of the driver, a sound shall be associated to the acknowledgement required to the driver.

5.2.4.7.8 Symbols and/or text messages associated with a yellow flashing frame

The flashing frame shall always be associated with a yellow symbol or a yellow text message.

5.2.4.7.9 Time frame for acknowledgement

The timeframe for acknowledgement should be within 10 s (± 1 s).

5.2.4.7.10 Disappearance of the flashing yellow frame

After acknowledgement within the time frame, the yellow flashing frame shall disappear and the symbol or text field shall turn to grey or white, or disappear if no longer relevant.

5.2.4.7.11 Violation of acknowledgement time frame

After violation of the time frame for acknowledgement, a technical system shall replace the flashing of the yellow frame with a steady yellow frame and trigger subsequent action.

NOTE The required technical system is not part of the display.

5.2.4.7.12 No flashing frame for fault management

For fault management (Symbol 111 “Read remedy”) no flashing yellow frame shall apply (no time frame exists).

5.2.4.7.13 Yellow symbol or text field

A yellow symbol or text field shall be used according to ISO 2575:2021, Clause 5, only when a driver’s action is requested (“= please act”). After driver’s action and all relevant end conditions are fulfilled, the symbol or text field shall disappear.

A yellow text field for fault indication may indicate the most relevant fault.

5.2.4.7.14 Red symbol or text field

A red symbol shall be used according to ISO 2575:2021, Clause 5. An intervention by the system can no longer be prevented by the driver, but subsequent action may be possible (e.g. see CLC/TS 50459 series).

5.2.4.7.15 Data entry

Data entry should follow the principles of [3].

5.2.4.7.16 Colours to be displayed

The display shall be able to display at least 256 colours.

5.2.4.8 Number of colours

The number of colours used should be limited. The set of predefined colours should not include more than 11 colours. When it is required to perform quick visual search based on colour distinction, it is recommended not to use more than six colours.

5.2.4.9 Combination of colours

5.2.4.9.1 General

The colour pairs to be distinguished shall comply with Table 3.

Table 3 — Combinations for foreground and background colours (according to Table 1) (see [5])

Character or symbol colour	Background colours permitted
white	black, dark grey, dark blue, dark night blue, light night blue, blue, dark red
black	white, grey, medium grey, ochre, yellow, orange, dark red, red, light red
blue	white, black, dark blue
yellow	black, dark grey, dark blue, dark night blue, light night blue, blue, dark red
orange	black, dark grey, dark blue, dark night blue, light night blue, blue
red	white, black, dark blue, dark night blue

5.2.4.9.2 Visibility and contrast

Visibility and legibility shall be ensured over a large angular field range (at least: vertically $\pm 45^\circ$, horizontally $\pm 35^\circ$ relative to the perpendicular direction of the display surface). The contrast ratio (transition of a pixel from black to white, or vice versa, when viewed perpendicularly to the entire screen) should on average be greater than 400:1. The percentage deviation from the average contrast value shall not exceed 10 %. Text or symbols on buttons shall be displayed in contrasting colour.

NOTE This requirement refers to the contrast ratio as well as to the deviation of colour intensity or colouring depending on the angular field.

5.2.5 Symbols

5.2.5.1 Use of symbols

Symbols are used for frequent, common and known indications. Symbols can also be used for context sensitive labels as part of a graphical language.

The symbols defined in Annex A, Table A.1 shall be used, if the corresponding function is available.

If a function is only optionally integrated in a display, the corresponding symbol shall be according to Table A.2.

If the indication is not described in this standard a text label or message should be used.

For new functions not yet addressed in this standard, new symbols may be needed. If the creator of a new symbol intends to promote the new symbol as a future standard, it should be registered with ISO/TC 145/SC 3 by using the template provided in Annex M (Figure M.1).

NOTE 1 Successfully registered symbols are provided on the website <https://www.iso.org/obp/ui/#search>.

NOTE 2 Successfully registered new symbols will be considered in future revisions of this standard.

Any new symbol in the scope of this standard shall respect the requirements of this standard, and shall preferably be based on dark background.

If text is used, this text should be short and unambiguous and indicate the function concerned (e.g. of a button).

5.2.5.2 Field for symbols

Symbols shall be displayed as a rectangular shaped field with minimum side lengths of 12 mm.

Exceptions are symbols for Class B CCS (legacy ATP systems) and symbols for timetable displays without shaped field.

5.2.5.3 No use of symbols in texts

Symbols shall not be used in a text message.

5.2.5.4 Inverse status

An inverse status should preferably be displayed by a self-explanatory symbol rather than by a symbol struck through. See Annex A.

5.2.5.5 Symbol style

The minimum thickness of symbol lines shall be 0,25 mm.

The minimum thickness of a line striking through a symbol shall be 1 mm.

5.2.5.6 Meaning of symbols

Information associated with buttons shall represent the status of functions to be achieved. Information on the screen not associated with buttons shall represent the status of functions available (see Annex A).

NOTE The meaning of symbols struck through that are not associated with buttons is that the train function cannot be activated.

5.2.6 Text

5.2.6.1 Principles for text

Any text displayed on the screen, e.g. words, sentences and questions, should meet the following requirements:

- terminology should be consistent, i.e. each word has one meaning and one word is used to express one meaning;
- the terminology should be in line with the operational tasks.

5.2.6.2 Requirements for text

Any text displayed on the screen, e.g. words, sentences and questions, governs the following requirements to provide usability and comprehensibility:

- to avoid overloading of the driver, not more than 5 text messages at the same time shall be presented on each basic screen.
- a conditional instruction shall start with the condition, e.g. “if ... then ...”;
- an instruction shall only give one condition and only one question shall be asked in one sentence;
- the active form of verbs shall be used;
- short main sentences shall be used; the length of headline messages should not exceed 40 characters;

- double negations and negative questions shall not be used;
- actions that are required of the driver should be at the beginning of the text information (e.g. ACK transition to Level 2);
- lower and upper case characters may be used.

NOTE For colours see 5.2.4.

5.2.6.3 Character type

No more than two different fonts and two types of emphasis (e.g. bold or underlining) should be used for the full set of applications provided by all screens in a driver's cab. For more details refer to EN 16186-2.

5.2.6.4 Minimum character height

In this standard, minimum dimensions for displayed information are defined. These minimum dimensions apply to all screens that are integrated in the three zones of EN 16186-2:2017, Annex A. Existing legacy equipment may deviate from this requirement.

If a screen is not integrated in the desk and the distance D between the screen centre and the mid-point of the tall driver's eyes (Point A in EN 16186-1:2014+A1:2018, Figure B.3) is more than 900 mm, then the following equation for the minimum character height H applies:

$$H = 0,0047 \cdot D$$

where

H is the character height;

D is the distance from Point A to the screen centre.

NOTE By the character height and the distance of the eye from the display, the angle α is created at the eye. The assumption is $\alpha = 16'$ so that $\tan \alpha = 0,0047$.

For H , a maximum tolerance of 10 % shall apply.

5.2.6.5 Typography

For screens integrated in the driver's desk in one of the three zones according to EN 16186-2:2017, Annex A, the following shall apply:

The minimum height of the characters, referring to the capital H (see ISO 15008:2017, 4.5.2) shall be:

- generally 3 mm;
- in headlines: 4 mm;
- for remedy information while driving: 5 mm.

The standard height of the characters should be:

- generally 4,5 mm;
- in headlines: 6 mm;
- for remedy information while driving: 7,5 mm.

The minimum line spacing should be 1,5 times the height of the characters.

5.2.6.6 Character spacing

The character spacing shall be such as defined for the chosen font.

The space between characters shall be as a minimum of one stroke width.

For other spacing requirements see EN ISO 9241-303:2011.

5.2.6.7 Numbers

When using numbers, leading zeroes shall not be shown (e.g. show 80 km/h not 080 km/h), unless it is essential (e.g. telephone number or digital time information).

5.2.7 Loudspeaker

5.2.7.1 Loudspeaker adjustment

The volume of the loudspeaker connected to a display shall be adjustable. EN 16186-2:2017, 6.4.4 shall apply. For further information see also EN 16186-2.

5.2.7.2 Simultaneous loudspeaker adjustment

If more than one loudspeaker system is used in the cab by other devices or functions, the adjustment of all loudspeakers simultaneously should be possible.

NOTE Possible solutions are the use of dedicated buttons outside the screen area, touchscreen buttons, automated systems making adjustments according to the ambient cab noise, or a combination of several solutions.

5.3 User/display interaction

5.3.1 Buttons

5.3.1.1 General

5.3.1.1.1 Button design

For the design of buttons and keys the following points should be taken into consideration:

- general principles;
- size of buttons;
- separation of buttons;
- shape of buttons;
- feedback of buttons.

5.3.1.1.2 Link between button and function

Buttons on touchscreens or soft key labels allocated to hard keys shall be provided only if the functions they represent are available.

On a hard key device, a pressed hard key without an allocated function should result in a displayed information (e.g. text message, pop-up window) that there is no function available.

5.3.1.1.3 Overriding hard key functionality by screen labels

The hard key provides the function shown on the hard key. Additional functions shall be provided by allocating screen labels to hard keys. In this case information provided by the screen label shall override information provided by the hard key.

5.3.1.1.4 Button feedback

5.3.1.1.4.1 General

If the transition towards the function launched by pressing the button takes more than 1 s, information shall be displayed, e.g. by the symbol in Table A.1, Pos. 60.

5.3.1.1.4.2 Visual feedback

Each time when a button is pressed, the sensitive area or allocated screen label shall be displayed inversely as long as the button is pressed.

5.3.1.1.4.3 Audible feedback

For hard keys there shall be an audible feedback except for keys to which no function is allocated, for example K1.6 or K1.7 or K1.9 (See Annex D). The audible feedback may be replaced or supported by a tactile feedback. For touchscreen buttons there should be an audible feedback ("click"). The audible information "click" is given as feedback while pressing the finger on a button. This "click" sound shall be played once. The "click" shall be compliant with "click.wav" file as defined by ERA-ERTMS 015560.

See also CLC/TS 50459 series.

5.3.1.1.4.4 Tactile feedback

The feedback of a pressed button may be tactile.

5.3.1.1.5 Position of text or symbols on buttons

The text or symbol of soft keys shall be placed in the middle of the button (i.e. in the middle of the soft key label in case of soft key technology).

5.3.1.1.6 Shape of displayed buttons

Buttons may be surrounded by shadowing with a maximum width of 1 mm to create a three-dimensional impression.

5.3.1.1.7 Location of button to prevent unintentional operation

To prevent unintentional operation, buttons activating opposite functions after pressing should not be put on the same button location (e.g. switching on/off).

5.3.1.1.8 Button location

A frequently used control function should have a specific button location, which shall be used for this function only, i.e. the same function should be always at the same location (e.g. to close the dialogue or to go back to the previous screen).

5.3.1.1.9 Location of [Close] button

The [Close] button shall not be adjacent to the [Enter] button.

5.3.1.1.10 Location of [Enter] button

When using soft keys the [Enter] button shall be presented on the right side of the screen.

5.3.1.1.11 Alternative provision for [Enter] button

When using a touchscreen the data field of the input field may also be used as the [Enter] button.

5.3.1.2 Size of a button

5.3.1.2.1 Minimum dimensions

The minimum size of a button shall be 144 mm²; the minimum width and height shall be 12 mm and should be 19 mm.

5.3.1.2.2 Buttons for acknowledgement

If a touchscreen device is used, buttons used for acknowledgement should have a rectangular surface of at least 1 500 mm².

5.3.1.3 Separation of buttons

5.3.1.3.1 Distance between buttons

Buttons shall not overlap each other. There should be a minimum distance between two adjacent buttons of 3 mm.

5.3.1.3.2 Coverage of sensitive button area

If a touchscreen is used, the touch sensitive area of the button shall be within the visible surface of the button and shall at least cover 95 % of the visible surface.

5.3.1.3.3 Adjacent location

If two buttons address different functions which should not be confused, they shall not be positioned adjacent to each other.

5.3.1.4 Button types

5.3.1.4.1 General

There are three ways in which a button can react to its activation (up, down or delay, see examples provided in Figure 2, Figure 3 and Figure 4.

The up-type button should be preferably used.

NOTE This requirement and the following requirements in 5.3.1.4 have been derived from [3].

5.3.1.4.2 Debouncing filter

There should be a debouncing filter to avoid erroneous double activation of a button. A value of 50 ms for the filter is recommended.

5.3.1.4.3 Up-type button

The up-type button shall mainly be used for activation of functions (see Figure 2).

By pressing the button, the button-down sound should be played. When the button is no longer pressed the activation shall be taken into account.

If on a touchscreen the driver selection continues, but outside the button itself (the finger slides out of the touch sensitive area belonging to the button) the activation shall not be taken into account. In that case the button shall return to a non-pressed state. When the finger slides back onto the button it shall be shown in pressed state again but this time without the button-down sound played.

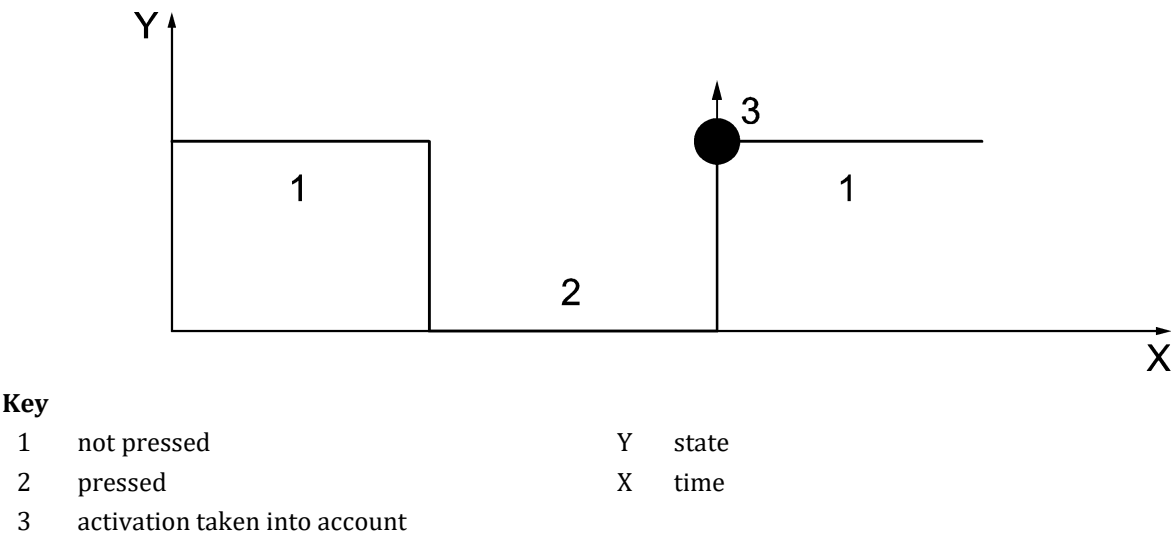


Figure 2 — Activation of an up-type button

5.3.1.4.4 Down-type button

The down-type button shall only be used for navigation on the screen, keyboard buttons and the delete button.

The activation is explained in Figure 3.

By pressing the button, the button down sound should be played and the activation shall be taken into account.

A down-type button can have a repeat function if the button remains pressed by the driver for longer than 1,5 s. After 1,5 s, the repeat function shall consider valid button activations each 0,3 s; the visual and audible indications are as if the driver was pressing on the button every 0,3 s.

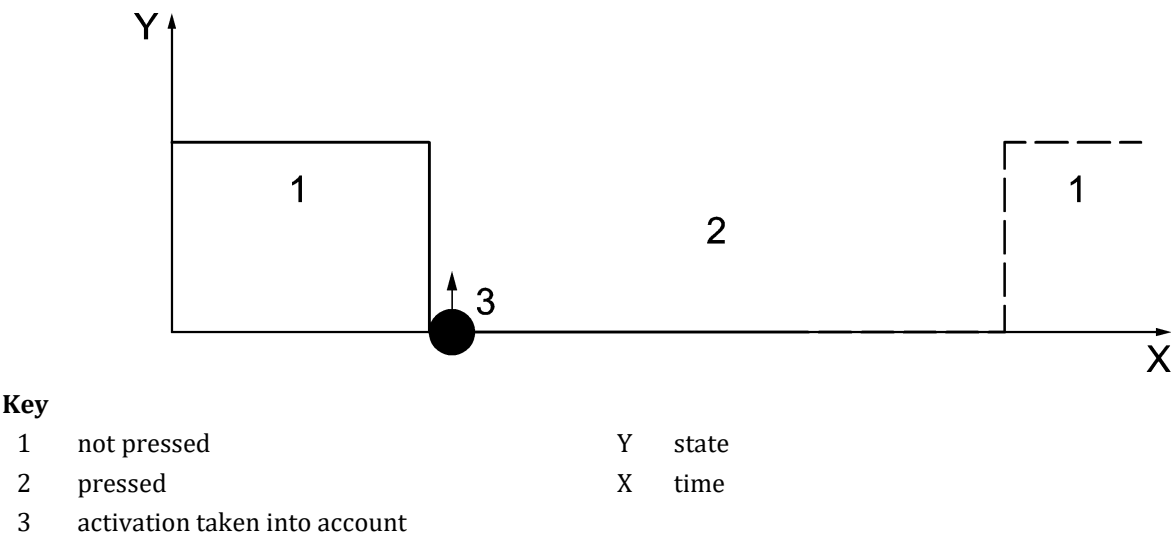


Figure 3 — Activation of a down-type button

5.3.1.4.5 Delay-type button

The delay-type button is similar to the up-type button but with a delay. It ensures that a quick press of the button is not taken into account by the system as a valid activation.

The use of the delay-type button should be avoided and if used, it should only be assigned to functions that should not be activated unintentionally.

On selection by the driver, the delay-type button shall change to the “pressed” state and the button-down sound should be played.

After two seconds, if the button is still pressed by the driver, the procedure according to the up-type button shall be followed.

If the button is pressed by the driver for less than the two seconds, the button shall return to the not pressed state, the procedure with the two seconds timer shall be reset and no valid button activation shall be considered (see Figure 4).

If, when using touchscreen technology, the driver selection continues, but outside the delay-type button itself (the finger slides out of the sensitive area of the button) the button shall return to the not pressed state, the procedure with the two seconds timer shall be reset and no valid button activation shall be considered. When the driver selection moves back to the delay-type button (the finger slides back onto the sensitive area of the button), the procedure with the two seconds timer shall start again but this time without the button down sound played.

5.3.1.4.6 Prevention of unintentional button activation

If unintentional button activation shall be prevented, there shall be an acknowledgement request.

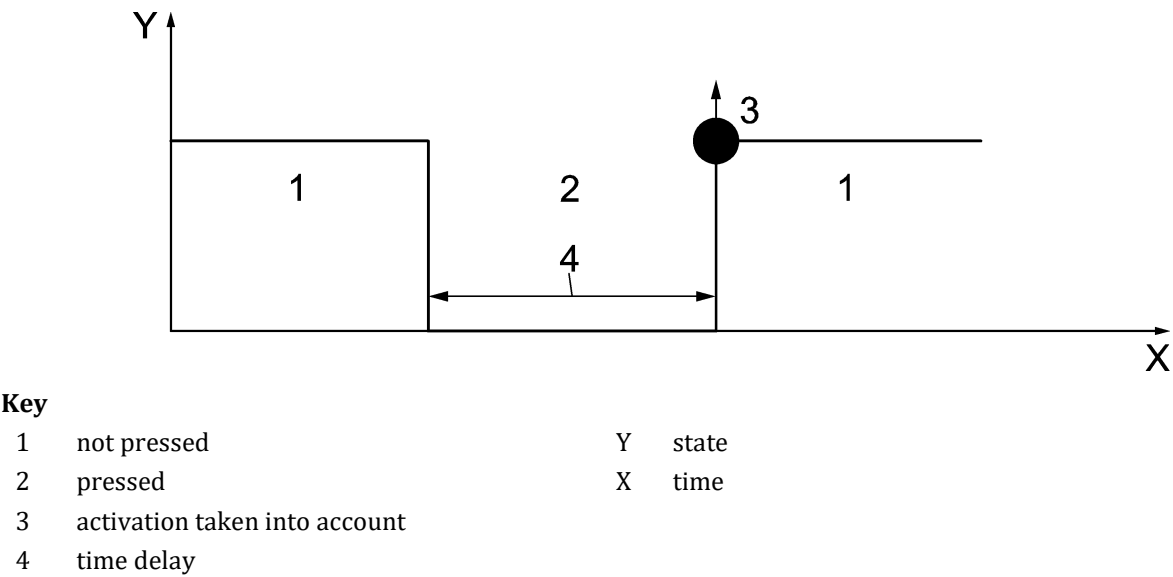


Figure 4 — Activation of a delay-type button

5.3.1.5 Navigation buttons

5.3.1.5.1 General

Navigation buttons shall be used to navigate through the dialogue.

5.3.1.5.2 Type of navigation buttons

5.3.1.5.2.1 Differentiation of navigation buttons

Navigation buttons shall be distinguishable from all other kinds of buttons. Navigation buttons shall be used consistently within all dialogues of the display. Navigation buttons having different meanings and system reactions after an action shall never have the same labels.

5.3.1.5.2.2 Symbols for navigation buttons

Navigation buttons shall use the symbols according to Annex A.

5.3.1.5.2.3 Navigation button type

Navigation buttons shall be down-type buttons.

5.3.1.5.3 Arrangement of navigation buttons

5.3.1.5.3.1 Intuitive use

There should be an intuitive use of navigation buttons.

5.3.1.5.3.2 Arrangement of navigation buttons in dialogues

The arrangement of the navigation buttons shall be identical throughout the dialogue.

5.3.1.5.3.3 Consistent principle

Within different screens of a dialogue the same consistent principle shall be followed.

5.3.1.5.3.4 Navigation buttons in lists or text

The navigation buttons in a list view or text shall have a repeat function (i.e. after pressing the navigation button for longer than 1,5 s the list or text shall move upwards or downwards), as long as the button is pressed or the first or last item of the list is reached.

5.3.1.5.3.5 Disabling of navigation buttons

If the first or last item in the list is the selected item, navigation buttons without function shall be disabled, if no wrap-around is desired.

5.3.2 Keyboards

5.3.2.1 Type of keyboard

For the entry of data, a keyboard may be used, whether external (e.g. on the desk, see EN 16186-2:2017, Annex B, Element 040) or on a display.

5.3.2.2 Arrangement of data keys

The arrangement of the (alpha)numeric data keys shall be identical throughout all dialogues and should be consistent with other keyboards used in the driver's cab, either consisting of soft keys or when using a touchscreen directly presented on a screen.

5.3.2.3 Display of keyboards on the screen

When displaying the keyboards on the screen, the data keys (buttons) should be presented in a predefined area throughout the dialogue as close to the input field as possible.

5.4 Input of data

5.4.1 General

The data entry should:

- avoid the need to enter the same information in the course of a train mission (e.g. train running number, driver ID) several times;
- have minimum number of button activations;
- require minimum navigation.

Examples are given in Annex J.

5.4.2 Entering (alpha)numeric characters

5.4.2.1 Use of cursor

The cursor shall be used to indicate where the next selection shall be inserted within the input field. The cursor shall be a highlighted field at the location where data may be entered

5.4.2.2 Delay time for automatic cursor movement

After entering (alpha)numeric characters, and when the data entered is displayed in the input field, the cursor shall be displayed automatically at the next position of the input field. The maximum delay-time for automatic movement of the cursor shall be 0,7 s.

5.4.2.3 Alphanumeric characters

To delete alphanumeric characters the [Delete] button on a touchscreen or K2.1 on a soft key display (see Annex D) shall be used.

On alphanumeric keyboards after pressing the [Delete] button on a touchscreen or K2.1 on a soft key display (see Annex D) for less than or equal to 1,5 s the cursor shall jump to the previous position of the input field, erasing the last entered character.

By pressing the [Delete] button on a touchscreen or K2.1 on a soft key display (see Annex D) for more than 1,5 s, the cursor shall move backwards through the input field as long as this button is pressed.

During this movement of the cursor the entered characters passed by the cursor shall be deleted.

5.4.3 Input fields

5.4.3.1 Dimensions of input fields

If the data entry is done on the display, the minimum height of the input field shall be 15 mm; the maximum length should be 100 mm.

If the entered data are not shown on the display, 5.2.6.4 “Minimum character height” shall apply for the size of input fields (example: keyboard on the desk, display not integrated in the desk).

5.4.3.2 Design proposals for input fields

Input fields should be designed according to Annex J, Example 1 or Example 2.

5.4.3.3 Highlighting of input fields

In case the input field is selected, it shall be shown highlighted.

5.4.3.4 Keyboards or lists associated with input fields

Once an input field is selected the associated keyboard or list shall be displayed.

5.4.3.5 No overlapping of the input field

Data keys shall not overlap the input field areas.

5.4.3.6 Options for entering or changing data input

For entering/changing data either predefined data or free data entered via keyboard shall be accepted.

5.4.3.7 Data entry proposal

For data that is likely to be unchanged in the course of a new data entry, the last valid entry may be displayed as proposal in the input field.

5.4.3.8 Number of character positions in the input field

The input field shall have enough character positions to display completely the data entered.

5.4.3.9 Function of [Enter] button for data entry

To acknowledge any input, the associated [Enter] button shall be pressed.

5.4.3.10 Input for free data

For any entry of free data (e.g. train length, brake percentage, etc.) a (alpha)numeric keyboard shall be provided.

If the number of characters needed by the dialogue is less than the number of character fields available in the input field, additional input of characters shall not be required by the dialogue (e.g. if the input "50" is needed, it is not permitted to ask for "0050"). For telephone numbers zeroes are permitted as first digits.

5.4.4 Input for predefined data

5.4.4.1 Lists

A list contains vertical positioned (scrollable) items. In case the amount of input possibilities is more than what fits into the size of a window, the input possibilities shall be displayed in a vertical (scrollable) list. A selection of an item shall be made via navigation buttons and confirmation by pressing the [Enter] key.

5.4.4.2 Structure of lists

The items of a list shall be presented in a structured order, e.g. in alphabetic, numeric, functional, time- or frequency-based order.

5.4.4.3 Dedicated keyboards

In some cases the choice of input data are limited: two (e.g. yes or no), three (e.g. P, G, or R), four (e.g. category A, B, C, D), etc. In those cases, the predefined choices shall be presented as data key labels.

5.4.5 Acknowledgements

5.4.5.1 General

Acknowledgement (ACK) can be performed on a display, but also outside the display. If done outside the display the arrangement is not part of this standard. The following applies only to a single application; the coordination between various applications is not part of this standard.

- Only one request for ACK shall be provided at once.
- There should be a reaction time of 10 s to activate the ACK after the request for ACK is provided. Deviating reaction times may be justified by specific constraints of an application, e.g. ETCS. Failure to respond to an application request may result in an automatic response depending on the application.
- Requests for ACKs shall be provided sequentially.
- The minimum delay time between an ACK and the next request for ACK shall be 1 s.
- The ACK button shall be an up-type button.

5.4.5.2 Colours for acknowledgements

For the use of colours, frames and flashing in the course of an acknowledgement process, see 5.2.4.

5.5 Troubleshooting

5.5.1 Fault indication requesting driver warning and acknowledgement (troubleshooting process)

Indication (visible/audible) shall be provided in two cases: TCMS-internal failure management causes a restriction for the operation of the rolling stock OR a driver action may help to solve a technical fault discovered by TCMS.

If a fault needs a time-critical acknowledgement, then a corresponding fault message is surrounded by a yellow-flashing frame. Flashing of the yellow frame stops when all time-critical faults have been acknowledged.

A number of predefined faults and warnings are defined in Annex A. Faults not defined in this standard may be categorized according to priority on project basis.

The sequence of displayed information/actions for one display shall be as follows:

- 1) The yellow symbol “Read remedy” (see Annex A, Table A.1, Pos. 111) with
 - either the fault-related symbol (see Annex A, Table A.1, Section HBEJ Provide diagnostic information);

OR, in case of no symbol available:

 - the general symbol “fault exists” (see Annex A, Table A.1, Pos. 112) and optionally a dedicated text message and/or audible advice;

shall appear in order to request that the driver opens the troubleshooting guide (fault management).
- 2) In case of only one non-acknowledged fault: after acknowledging the fault by pressing the “provide remedy” button (see Annex A, Table A.1, Pos. 13), a remedy for the fault is offered.

- 3) In case of more than one non-acknowledged fault at the same time: after pressing the “provide remedy” button, either a list of these faults shall be displayed, or the remedy of the first entry of the list shall be displayed and this entry is acknowledged. If the TCMS is able to rank the faults by priority, the fault with the highest priority shall be displayed first. If there are several faults with the same priority, the oldest of them shall be displayed on top of the list. If the TCMS is not able to rank the faults, the faults shall always be listed in ascending time order (oldest on top) or descending order (newest on top). A fault is acknowledged by selecting it with the cursor and by opening the associated remedy by the [Acknowledgement] key (see Annex A, Table A.1, Pos. 6).
- 4) After returning to the basic screen and if there is no non-acknowledged fault, the “Read remedy” symbol shall not be displayed anymore. If a fault has not been solved, the related symbol OR the general symbol “fault exists” will be displayed as long as a fault remains.

5.5.2 Fault indication not requesting driver warning and acknowledgement

Diagnostic information that does not request driver warning and acknowledgement may be provided in a submenu of the TDD.

See also Annex G for categorization of faults.

Annex A (normative)

Symbols, text messages and audible messages

A.1 General

This annex defines the symbols, text messages and audible messages that shall be used, if the related function is provided. Where no symbol is provided, a text message only applies.

The position numbers in the start and end condition (Columns H and I) of Table A.1 and Table A.2 refer to EN 16186-2:2017, Annex B.

For the exact colour description, especially of background colours, see 5.2.4.

For the location of symbols, see Annex E. CCD Area G refers to the area defined in the ETCS DMI specification.

Where a symbol is used for command purposes (soft key or button) no start and end conditions apply.

NOTE Symbols are not limited to use in a central position on a button. From an ergonomic point of view, the central position is generally the preferred position.

The pictogram which represents an equipment or a function unavailable due to a failure or due to an inhibition but which is reversible by the driver or automatically (e.g. isolation) uses the following format:



The pictogram which represents an equipment or a function unavailable and not reversible by the driver uses the following format:

A.2 Mandatory symbols and text messages

Table A.1 contains the mandatory symbols and/or text messages. The position numbers in Column A are reference numbers in this document.

The symbols and text messages may be used for status indication and/or for command, see Column B and Column C.

NOTE 1 Command can be e.g. a button, differentiated from the status symbol by shadowing.

DMI applications are CCD, TRD, TDD, ETD, CCTV, etc.

NOTE 2 The symbol is used if the function is provided by the application.

Text messages are reduced to a minimum.

See Table 2 for information regarding the meaning of colours.

The functions and their coding (e.g. HBD = ensure display of information) are according to EN 15380-4 (see Annex K, Table K.1).

If a start/end criteria cell is empty, the symbol and/or text message shall always be displayed, as long as the display is activated. If reference to Annex F is given in Column E, the symbol and/or text message shall be provided in the referenced submenu.

WARNING — Functional aspects of start/end criteria specified in this standard are based on the following principle: Every functional specification standard which has a human-machine interface covered by this standard shall notify this interface by a reference to this standard. Any change of such start/end criteria shall therefore be requested by the functional specification standard dealing with this interface.