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Železniške naprave - Komunikacijska sredstva med signalnovarnostno opremo in vmesniki človek-stroj (MMI)

Railway applications - Communication means between safety equipment and man-machine interfaces (MMI)

Applications ferroviaires - Moyens de communication entre l'équipement de sécurité et l'interface homme-machine (IHM)

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Railway applications - Communication means between safety equipment and man-machine interfaces (MMI)

Applications ferroviaires -
Moyens de communication entre
l'équipement de sécurité et l'interface
homme-machine (IHM)

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CENELEC

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Foreword

This Technical Report was prepared by the Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

It was circulated for voting in accordance with the Internal Regulations, Part 2, Subclause 11.4.3.3 (simple majority).

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

This Technical Report has been prepared under a Mandate M/334 given to CENELEC by the European Commission and the European Free Trade Association.

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Introduction

The purpose of this Technical Report is to show how to harmonise the communication means between onboard signalling safety systems and the driver-machine interface in the driver's desk.

The need for this standardisation has grown out of several trends.

One trend is that the rolling stock is being computerised more and more, enabling sophisticated functions within the rolling stock and various subsystems of the train.

Further, the driver's desk of such rolling stock is built around one or several computer screens [1]. These allow the driver to interact with the computerised rolling stock functions. The user interfaces are typically user friendly, feature e.g. graphics and colours.

In case of degraded situation (screen failure) and with several screens available on the desk, it should be possible to relocate important information to a screen that is still working. This improves operational availability.

Another trend is the harmonisation of onboard signalling safety equipment. The ERTMS/ETCS as defined by the directive 96/48/EC and the related Control-Command TSI defines a control-command signalling system on European level.

For ERTMS/ETCS onboard, the driver-machine interface is also based on computerised screen(s).

The ERTMS/ETCS defines the concept of Specific Transmission Module STM, allowing the existing national control-command systems to be modified into an STM. This allows integration between national control-command systems and ERTMS/ETCS onboard equipment via a standardised interface (FFFIS STM).

Since desk space is a limited resource, the STM concept allows national onboard control-command systems to use the driver machine interface resources of ERTMS/ETCS. This is one aspect of the integration of national equipment with ERTMS/ETCS onboard.

Therefore the ERTMS/ETCS driver machine interface allows the driver to interact with any of the installed STMs or/and ERTMS/ETCS onboard. The selection of the active system is a responsibility of ERTMS/ETCS.

A third trend is that a European market is opened for control-command equipment as well as rolling stock.

Traditionally, control-command systems were generally linked to a country, and rolling stock was equipped with one or more national signalling safety system. This has effectively limited the rolling stock to operate within a limited number of countries.

The ERTMS/ETCS, in combination with STMs makes available onboard signalling safety equipment that enables cross-border traffic, freeing rolling stock from this barrier.

There are indeed other barriers hindering cross-border traffic, being operational, technical or administrative. They are gradually being overcome. One example is the interoperable voice radio, EIRENE, based on GSM-R.

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[1] In this Introduction the term "screen" is used in a popular sense, implying e.g. touch screen or other means of input from driver.

The combination of the above trends leads to the conclusion that during train operation, ERTMS/ETCS must have access to one of the screens in the desk. Further, it is desirable to maintain the advantages of multi-screen installations created by train system providers, allowing the ability to change screen for ERTMS/ETCS in case of screen failure. Thus a certain level of integration and harmonised communication is called for.

Another motivation for this Technical Report is related to Life Cycle Cost. The interface shown here helps replacement of screen and desk equipment through the lifetime of the vehicle, whatever is the supplier.

1 Scope

This Technical Report defines, in accordance with the ERTMS/ETCS requirements:

a) for each DMI function to be exchanged to and from the driver, including ETCS, STM:

— performances needed;

— degraded modes recovering;

b) DMI Safety targets;

c) communication system requirements:

— real-time capability;

— performances (bandwidth, etc.);

— expansion capability;

— RAMS;

— applicable standards;

— degraded modes;

— degraded modes management;

— interface with other systems;

— LCC requirements.

Each item in the list above corresponds to one chapter of the present document.

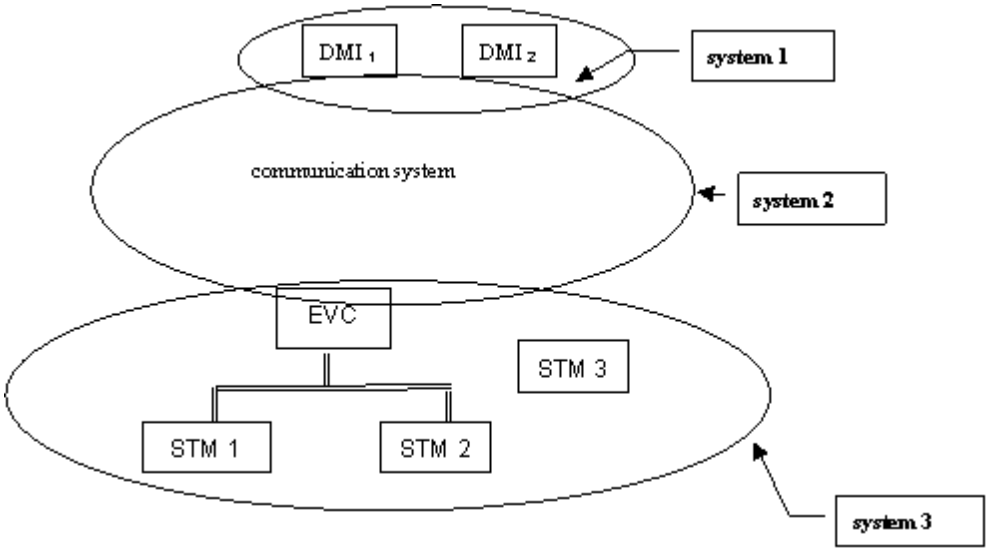

Figure 1 - Systems concerned by this document

This Technical Report does not cover the following items:

— Train functions;

— STM “Separate DMI” as defined in document [1] regarding DMI equipment that is part of the STM itself;

— GSMR EIRENE functions;

— Ergonomics;

— Use of the ETCS DMI as a terminal server for maintenance purpose.

2 Normative references

The following referenced documents are indispensable for the application 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.

96/48/EC, *Council Directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system*

EN 50128, *Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems*

EN 50129, *Railway applications - Communication, signalling and processing systems - Safety related electronic systems for signalling*

EN 50155, *Railway applications - Electronic equipment used on rolling stock*

EN 50159-1, *Railway applications - Communication, signalling and processing systems - Part 1: Safety-related communication in closed transmission systems*

EN 50159-2:2001; *Railway applications - Communication, signalling and processing systems - Part 2: Safety-related communication in open transmission systems*

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

CLC/TS 50459-6, *Railway applications - Communication, signalling and processing systems - European Rail Traffic Management System - Driver-Machine Interface - Part 6: Audible information*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

Figure 2 is given to illustrate the relationship between some definitions.

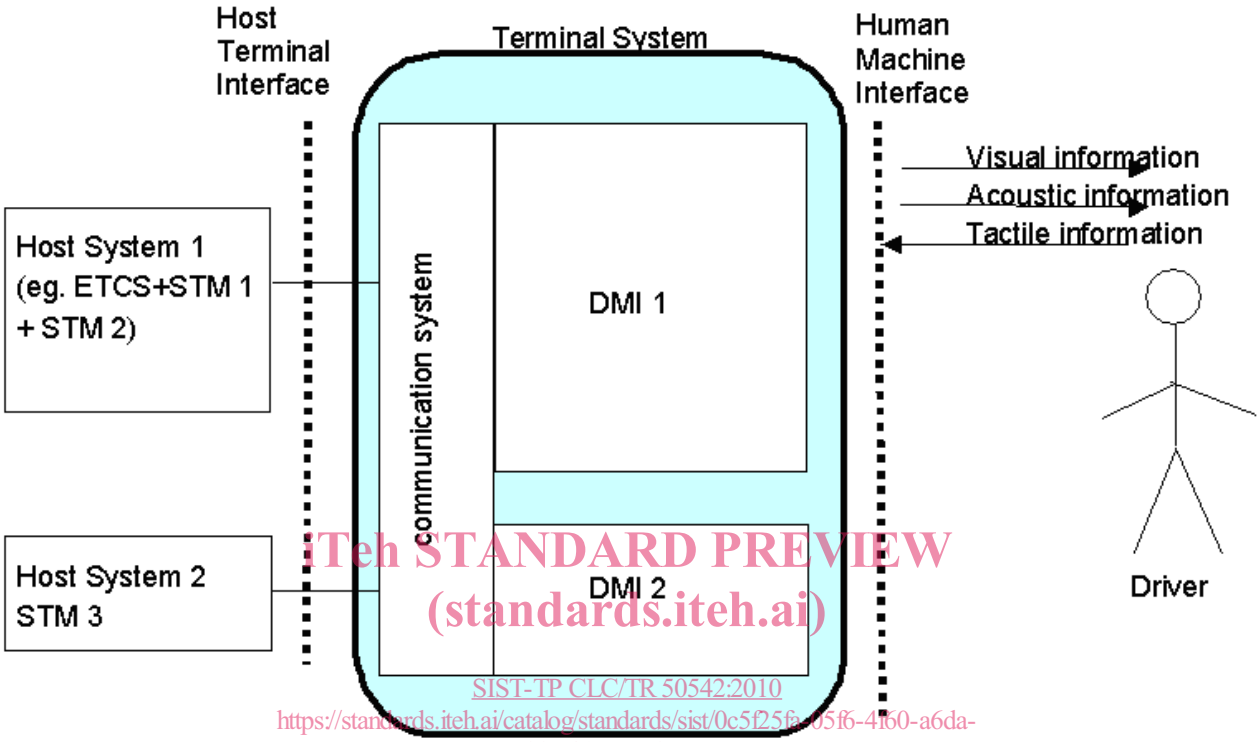

Figure 2— Terms and definitions

3.1
Human-Machine Interface
functional interface between the DMI(s) and the driver

NOTE Information is carried through this interface in the form of visual (light), acoustic and tactile (driver's pressing of buttons). One HMI is associated with one or more DMIs.

3.2
Driver Machine Interface
equipment to support one HMI. It contains the hardware and software means to support HMI

3.3
Host System
equipment communicating with the Driver via DMI

3.4
host application
functional service allocated in a Host System

3.5
terminal system
system comprising the communication system and at least one DMI in a desk

3.6
hard key
physical key not part of the display area. This key can also have a text label or symbol

3.7
communication system
system connecting one or more Host System to one or more DMIs and/or to other HS

3.8
softkey
context-dependent key which consists of hard key with an associated label on the display area

3.9
in-function
exchange of information (data) from the driver to the onboard system

3.10
out-function
exchange of information (data) from the onboard system to the driver

3.11
button event
pressing or releasing a button

3.12
button
object shown to the driver through which the driver action is possible. It is composed of a label and the associated sensitive area

NOTE The sensitive area of a button can be accessed via a touch screen area or via hardkey, depending on the chosen technology.

3.13
dimmed
areas which appearance has been made less conspicuous than other areas

3.14
indicator

object with a label shown to the driver for which no driver action is possible

3.15
sensitive area
surface on which a driver can make a physical action to give input to the HS

3.16
Object Control
data exchanged between Host System and DMI

3.17
label
symbol or text indication on an indicator or a button

4 Symbols and abbreviations

ASIC	Application Specific Integrated Circuit
CRC	Cyclic Redundancy Code
DMI	Driver Machine Interface
EMC	Electromagnetic Compatibility
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
EVC	European Vital Computer
FDL	Field Data Link
FMEA	Failure Mode and Effects Analysis
FRS	Functional Requirements Specification
FFFIS	Form Fits Functional Interface Specification
HMI	Human-Machine Interface
HTI	Host Terminal Interface
HW	Hardware
IL	Implicit Layer
LCC	Life Cycle Cost
MTBF	Mean Time Between Failures
OC	Object Control
Profibus	Process Field Bus
RAM(S)	Reliability, Availability, Maintainability, (Safety)
SAP	Service Access Point
SLL	Safe Link Layer
STL	Safe Time Layer
STM	Specific Transmission Module
SW	Software

5 Devices / modules of the systems

The different systems shown in Figure 1, are detailed hereafter:

1) the DMI(s). It can be constituted of (or it can be considered as the assembly of):
   - input devices (from the driver to the system);
     - button(s). The button(s) can be hardkeys or softkeys or an area on a touch screen, the so-called "button event",
     - etc.;
   - output devices (from the system to the driver);
     - visual devices,
     - acoustic devices,
     - etc.;
   - a processing unit.
2) a communication system. It is constituted of:
   - a hardware subsystem;
   - a software subsystem.
   - Each of those subsystems can be distributed on different devices.
3) the connected equipment (HS: for instance, EVC/STM system).

6 DMI functions for ERTMS/ETCS

6.1 Concepts

6.1.1 Object Controls

The study of exchanges between the driver and the ERMTS/ETCS system has led to define the following generic Object Controls, that must be exchanged between Host System and DMI (see Table 1 to Table 4).

NOTE Those OCs must be usable by any HS connected to the communication system defined in this document.

Table 1 — Object Controls from HS to DMI

From Host System to DMI	Name
Button request	BR
Indicator request	IR
Text message request	TMR
Text message deletion	TMD
Sound request	SR
Data entry request	DER
Data confirmation request	DCR
Dataview request	DR
Continuous dataview request	CDR